I. C. 6995 FEBRUARY 1938

UNITED STATES
DEPARTMENT OF THE INTERIOR
HAROLD L. ICKES, SECRETARY

BUREAU OF MINES
JOHN W. FINCH, DIRECTOR

INFORMATION CIRCULAR

RECONNAISSANCE OF MINING DISTRICTS IN HUMBOLDT COUNTY, NEV.

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BY

WILLIAM O. VANDERBURG

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UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

RECONNAISSANCE OF MINING DISTRICTS IN HUMBOLDT COUNTY, NEV.[1]

By William O. Vanderburg[2]

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2/ Mining engineer, Mining Division, Bureau of Mines.

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FOREWORD

This is one of a series of circulars dealing with mining and milling operations in various mining districts in the Western States. Data on operating costs, grades of ore treated, wage scales, haulage rates, and other information on mining properties are obtained from the operators and other local sources during the course of field inspections. They are believed to be substantially correct as to conditions at the time the properties were visited, but may not be in accord with facts established by later developments.

CHAS. F. JACKSON,
Chief Engineer,
Mining Division.

INTRODUCTION

This paper gives the results of a reconnaissance of the mining districts in Humboldt County, Nev., made during the month of June, 1937[3]. During the field work, virtually all the mining districts in the county were visited and many data were obtained on a number of active and inactive properties. No attempt has been made to include in this report all the properties in the various mining districts, and it should be emphasized that whether or not a property is mentioned herein has no bearing on its merit. The report covers the location of the various mining districts, types of deposit, information on past operations and current activity, and general information likely to be useful to operators, investors, and others interested in mining. The geology of the deposits is discussed only briefly.

The names of the various mining districts mentioned in this report are those generally used when they were organized for purposes of record and regulation. As organized, the districts embraced large areas with no definite boundaries, and the names have little significance.

Mining began in Humboldt County in the early sixties as the result of prospecting stimulated by the discovery of the Comstock lode in 1859. In the sixties and seventies speculation in mining ventures was rife and much money was spent unwisely. A number of small mills were erected along the Humboldt River and other places, but most of them did not operate successfully either for lack of ore or because of the metallurgical difficulties encountered in the treatment of the base ores. The outstanding discovery in the area now included in Humboldt County, from the viewpoint of production, has been the National district, noted for its bonanza ore. The greatest activity took place from 1907 to 1915. Following the decline of the National district, mining was carried on for the next 20 years by lessees and small companies. In 1935 mining activity was stimulated by the discovery by G. C. Stagg and Clyde Taylor of the Jumbo mine in the Awakening district. Considerable publicity was given this discovery and many claims were located in the area. Other districts that had been idle for many years received attention, with the result that the mining industry in the county is brighter at the present time than it has been for many years.

3/ Manuscript completed August 7, 1937.

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ACKNOWLEDGMENTS

The author wishes to thank the owners, lessees, and mine operators, too numerous to mention individually, who wholeheartedly provided information and assistance during the course of the field work.

Charles White Merrill, of the Mineral Production and Economics Division, Bureau of Mines, furnished data for the mineral-production tables; and the Mackay School of Mines, University of Nevada, at Reno, cooperated in making mineral determinations and assays and in permitting the use of its technical library.

HUMBOLDT COUNTY

General

Humboldt County, in northwestern Nevada, was one of the nine original counties created by an Act of the Territorial Legislature approved Nov. 25, 1861. Originally it comprised 23,490 square miles, but by an Act approved Dec. 19, 1862, about one-third of this area was ceded to Lander County, and by an Act approved March 17, 1873, another small portion of the southeast corner was also ceded to Lander County, leaving the boundary between the two counties as it is at present. Subsequently, two small triangular sections of territory were ceded to Churchill County, and by an Act of the State Legislature approved March 18, 1919, the southern part of Humboldt County, comprising an area of 6,113 square miles, was withdrawn to form Pershing County.

Figure 1 is a sketch map of the county. Its area is 9,304 square miles, approximately equal to either that of the State of New Hampshire (9,341 square miles) or the State of Vermont (9,564 square miles). The water area embraces two small lakes in the northwestern part of the county - High Rock Lake, 1.2 square miles, and Summit Lake, 1.2 square miles.

The county derives its name from the Humboldt River, which enters it near the southeast corner, runs northwest for 60 miles, and then turns to the southwest, emptying into Humboldt Sink in Pershing County.

The first county seat was at Unionville (now in Pershing County), and on May 1, 1873, it was removed to Winnemucca, the present county seat and commercial center. Winnemucca is situated on the banks of the Humboldt River at the Great Bend, which name was given by the early emigrants to the place where the river turns from a northwest to a southwest course. The town was established in 1850 as a small trading station on the Overland route to the California goldfields, and it was then known as French Ford. Later the name was changed to Winnemucca in honor of a Pahute Indian chief.

According to the census of 1930, population of the county was 3,735, an average of one person to each 2.58 square miles. About one-half of the population reside in Winnemucca. The principal industries are stock-raising, agriculture, and mining.

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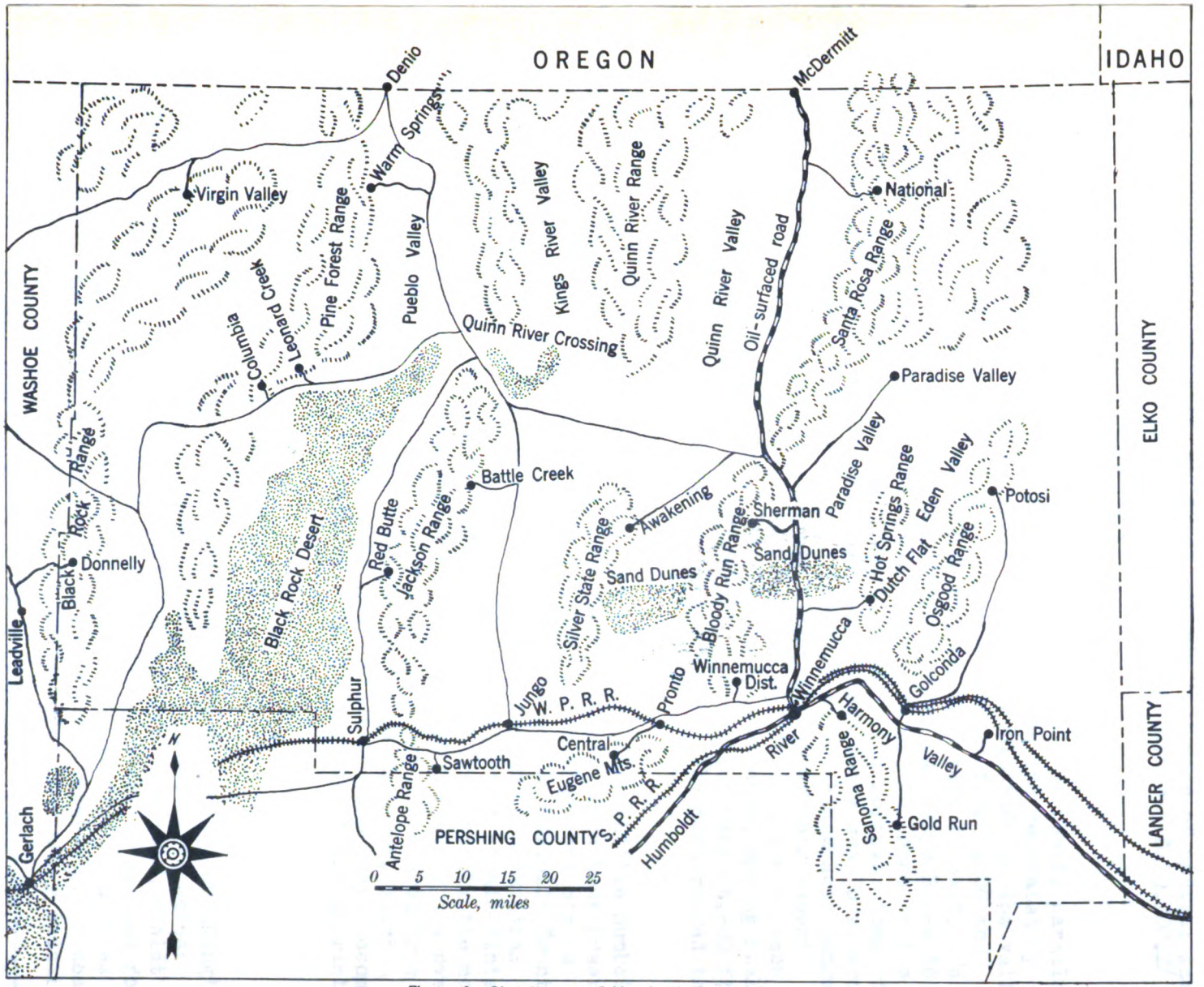

Figure 1.—Sketch map of Humboldt County, Nev.

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The assessed value of real property in the county for the fiscal year 1935-36 was $14,026,890, and the tax rate for the same period was $1.96 per $100, which included a State tax of $0.68 but was exclusive of special taxes. The bonded indebtedness of the county for the same period was $120,000.4/

Topography

Topographically, Humboldt County comprises a series of nearly parallel mountain ranges extending approximately north and south and separated by troughlike valleys from 10 to 20 miles in width. The altitude of the valley floors ranges from 4,000 to 5,000 feet and the mountains from 5,000 to 9,500 feet above sea level. The principal ranges, from west to east, are the Black Rock Range, Pine Forest Range, Jackson Range (Antelope Range to the south), Silver State Range, Santa Rosa Range (Bloody Run Range to the south), and the Osgood Range (Table Mountain Range to the north). Some of the more prominent mountain peaks and their elevations above sea level are Division Peak (8,585 ft.), Pahute Peak (8,618 ft.) in the Black Rock Range, Duffer Peak (9,422 ft.) in the Pine Forest Range, King Lear Peak (about 8,900 ft.) in the Antelope Range, Trident Peak (8,407 ft.) in the Jackson Range, Granite Peak (about 9,600 ft.) in the Bloddy Run Range, Spring Peak (about 9,400 ft.), Rose Peak (about 9,600 ft.), and Capitol Peak (8,200 ft.) in the Santa Rosa Range. The mountain ranges are generally more rugged than those farther south.

The principal valleys in the county are Eden, Paradise (Little Humboldt River, Quinn River, Humboldt River, King's River, and the Black Rock Desert. The valleys constitute a series of basins without any surface outlets to the sea. Because of this interior drainage, the valleys in Humboldt County as well as those in other parts of the State have peculiar topographical features becoming, according to conditions, meadows, sinks or alkali flats. The Black Rock desert in the western part of the county is probably the most desolate area in the State. This desert is a vast playa formed by the evaporation of a former lake. In winter a portion of this playa is covered by a shallow lake formed by water furnished mainly by the Quinn River, which empties into it. During the summer months the surface of this playa becomes compact and hard, so that when an automobile is driven over it the imprint of tires is barely discernible.

Water Resources

The principal rivers in the county are the Humboldt, Quinn, and King's Rivers. The Humboldt, longest and largest river in Nevada, flows across the southeast corner of the county and normally empties into the Humboldt Sink in southwest Pershing County. Most of the water, however, is used for irrigation before it reaches Humboldt Sink. The Quinn River, which rises in the Santa Rosa Range near the Oregon boundary, flows southwesterly for nearly a hundred miles, meandering through Quinn River Valley. It finally dwindles

4/ Germain, J. L., Annual Report of the Auditor of the County of Humboldt, State of Nevada, Fiscal Year June 30, 1935, to July 1, 1936, pp. 15-16.

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away and disappears in the Black Rock Desert. Its chief tributary, the King's River, is fed by mountain streams in the northern part of the county and in Oregon. The Little Humboldt River, which joins the Humboldt at Winnemucca, is also one of the more important streams in the county. The habit of designating many of the streams in Nevada as rivers gives them an importance on the map which they do not deserve as far as size is concerned. The Humboldt River, as well as the others, is generally fordable along its entire length during the summer.

In addition to the foregoing, there are numerous mountain streams, some of which carry enough water for irrigation. Unlike normal streams found elsewhere, the volume of water generally diminishes as they descend into the valleys, and in some cases during the summer months the channels are dry, as the water is lost by seepage and evaporation.

Agriculture is restricted to those areas that can be irrigated, since the rainfall is insufficient to meet the needs of growing crops. The principal agricultural areas are Paradise (Little Humboldt River), King's River, Quinn River, and Humboldt Valleys.

Numerous springs are distributed throughout the mountain ranges of the county, and frequently they are able to furnish enough water for milling and domestic use. The only artesian well in the county, to the writer's knowledge, is one drilled in 1936 at Winnemucca to supply the town with water. This well is 525 feet deep and the flow is about 550 gallons per minute. The log of the well is as follows:

Depth from surface, in feet.	Remarks
0-4	Sandy loam.
4-15	Quicksand, surface water at 10 feet.
15-19	Cemented gravel.
19-27	Loose gravel.
27-112	Slightly cemented gravel.
112-120	Large boulders.
120-135	Conglomerate.
136-150	Sandy clay.
150-233	Conglomerate cemented gravel.
233-397	Sandy clay; small amount of water, but did not rise in well.
397-403	Sandy gravel.
403-470	Clay.
470-475	Sand, small artisian flow approximately 5 G.P.M.
475-494	Clay mixed with gravel.
494-497	Cemented cap rock.
497-503	Lava gravel and lava boulders, artisian water flowing at approximately 140 G.P.M.
503-525	Fissured solid lava; flow, 550 gallons; temperature 62.3°F.

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Climate and Vegetation

The climate of Humboldt County varies according to the elevation, which ranges from about 4,000 feet in the valleys to nearly 10,000 feet in the highest mountains. For most of the area a temperate climate prevails; the summer days are comfortably warm, and the nights are invariably cool. During the winter the climate may be of Arctic severity for short periods, with a temperature of 40° below zero. In nearly all of the mining districts mentioned in this report, mining can be carried on the year round without difficulty. Some of the camps at altitudes greater than 7,000 feet may be snowed in for several months during severe winters.

Precipitation varies according to the altitude, being greater on the mountains than in the valleys. No data are available on annual precipitation, but probably it is between 12 and 20 inches per year. With the exception of the valley playas, which are filled with a mixture of silt and alkali salts injurious to vegetation, there is some kind of vegetation over the whole area. In the valleys it consists chiefly of sagebrush and greasewood, while on the mountain slopes above a general elevation of 7,000 feet there are scattered growths of juniper, mountain mahogany, and piñon pine. The forested parts contain no saw timber, and the growths are fit only for firewood and the construction of corrals and fences.

Power Facilities

Virtually all the mining districts in Humboldt County depend on internal-combustion engines for power. In June 1937 the Sierra Pacific Power Co. was extending its transmission line from a point near Mill City, Nev., to Winnemucca and Golconda, thence north to the Getchell mine. When this line is completed, public-utility power service will be available to those mining areas within convenient distances.

Transportation Facilities

The main line of the Western Pacific Railroad traverses the southern part of the county in an east and west direction, and the main line of the Southern Pacific Railroad cuts across the southeast corner following the course of the Humboldt River. Both railroads pass through Winnemucca. The northern part of the county is isolated as far as railroad transportation is concerned as there are no branch railroads in this region.

Victory Highway (U. S. Route 40), connecting Salt Lake City, Utah, and San Francisco, Calif., passes through the southeastern portion of the county. This highway is oiled. An oiled road also connects Winnemucca and McDermitt, Nev. Virtually all of the districts mentioned in this report can be reached by automobile over either gravel or dirt roads.

The Western Pacific Railroad freight rates on carload shipments of ore from Sulphur, Antelope, Jungo, Venado, Gaskell, Raglan, Winnemucca, and Golconda to Utah smelters are as follows:

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Value of ore per ton	$10	$15	$20	$30	$40	$50	$60	$70
40-ton car	3.20	3.20	3.20	3.90	4.60	4.75	5.25	6.00
20-ton car	4.00	4.00	5.00	5.50	6.00	6.50	7.00	7.50

Value of ore per ton	$80	$90	$100	$110	$120	$130	$200	$300
40-ton car	6.75	7.50	8.25	-	-	-	-	-
20-ton car	8.00	8.50	8.85	9.10	9.35	9.50	10.00	10.00

The Southern Pacific Railroad freight rates on carload shipments of ore from Golconda, Winnemucca, Valmy, and Iron Point to Utah smelters are as follows:

Value of ore per ton	$20	$30	$40	$50	$60	$70	$80
40-ton car	3.20	3.90	4.60	4.75	5.25	6.00	6.75
20-ton car	5.00	5.50	6.00	6.50	7.00	7.50	8.00

Value of ore per ton	$90	$100	$110	$120	$130	$150	$200
40-ton car	7.50	8.25	-	-	-	-	-
20-ton car	8.50	8.85	9.10	9.35	9.50	9.50	10.00

History of Mining

The region comprising the State of Nevada was part of the territory acquired from Mexico by the treaty of Guadalupe-Hidalgo, signed Feb. 2, 1848. In September 1850 it was organized as part of the territory of Utah. By Act of Congress approved March 2, 1861, the Territory of Nevada was created, and on Oct. 31, 1864, it attained the rank of Statehood.

Probably the first white men to see the northern part of Nevada were those in the Jedediah S. Smith expedition of 40 trappers in 1825-26. This expedition followed the course of the Humboldt River Valley, which is the most natural east-west route across the northern part of the State. Other exploration and emigration parties that followed in Smith's footsteps were the Peter S. Ogden expedition in 1831, Milton Sublette's in 1832, Captain B. L. E. Bonneville's in 1833 (whose adventures were immortalized by Washington Irving), the emigration party under Captain J. B. Bartelson in 1841, and General John Fremont's expedition in 1843-44. These expeditions culminated in the rush of '49 to the gold digging of California. The overland travel across Nevada in the early days followed the course of the Humboldt River to a place known as "Lassen Meadows", about 4 miles west of Humboldt House. Here the route divided, the main line of travel going across the river to the northwest, out through Cedar Springs Pass, across the Black Rock Desert, through Susanville, and over Beckwith Pass in the Sierras to the placer fields of California. The other route went to the southwest, to Fort Churchill, on to Carson City, and up the west Carson River, around the southern end of Lake Tahoe, to Placerville, Calif. The early pioneers hurried over the arid stretches of Nevada with a minimum of delay, and the northern part of what is now Humboldt County remained a "terra incognita" because of its isolation and the hostile disposition of the Bannock Indians, who roamed the northern part of the State.

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Probably the first mineral found by a white man in what is now Humboldt County was found by Allen Hardin in 1849 on the edge of the Black Rock Desert while traveling with a party of emigrants to the west coast. This "discovery" is interesting, since it has been the subject of more speculation and the cause of more fruitless search and greater disappointments in the vicinity of the Black Rock Desert than discoveries in any other section of the State. It is a story of another "lost mine", and the facts gathered from various sources are substantially as follows:

In the summer of 1849, Allen Hardin, in company with other emigrants, arrived almost destitute on the edge of the Black Rock Desert. Hardin, with two companions, had left the main party in search of game for food. This region is one of the most barren and desolate sections in Nevada and the hunters found no game. However, on their return to camp they brought with them a piece of metal that weighed about 25 pounds, and they tried to get a member of the party to haul it to California for them. The party in question was short of oxen to haul his own property and he informed them that he would not pack it, even though it were pure gold. They were forced to leave the specimen beside the road, but before doing so they made a small button by melting a piece and molding it in the sand. Upon arriving in California the button was assayed and showed high values in silver. The rock that was left along side the road was found several months later by another party of emigrants and brought to Sacramento, where it was placed on exhibition in the leading bank at that time. In succeeding years numerous parties, numbering as high as 70 members in a single party, were organized by Hardin and others to search for this "lost mine", but these efforts were fruitless. Probably the metal found by Hardin was a specimen of hornsilver float from the Silver Camel mine near Sulphur.

The discovery of the Comstock Lode in western Nevada in 1859 was followed by an era of wild excitement and speculation, and prospectors turned their attention to other parts of the State. Humboldt County was not overlooked. Mining activity began here in 1860 with the organization of the Humboldt Mining District, followed by numerous other districts, many of which were short-lived. It was a period when anything new in mining had tremendous possibilities and the only fear was that the enormous quantity of silver believed to be present in the mountains of Nevada would destroy the value of that metal and upset the monetary stability of the world. The following extract from a letter[5/] written in Virginia City in April 1860 gives a vivid picture of the condition of society at that time.

5/ Browne, J. Ross, and Taylor, James W., Reports Upon the Mineral Resources of the United States: Washington, Government Printing Office, 1867, p. 28.

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***. Of a certainty, right here is Bedlam broke loose. One cannot help thinking, as he passes through the streets, that all the insane geologists extant have been corralled at this place. Most vehement is the excitement. I have never seen men act thus elsewhere. Not even in the earlier stages of the California gold movement were they so delirious about the business of metalliferous discovery. Hundreds and thousands are now here, who, feeling that they may never have another chance to make a speedy fortune, are resolved this shall not pass unimproved. They act with all the concentrated energy of those having the issues of life and death before them. They demean themselves not like rational beings any more. Even the common modes of salutation are changed. Men, on meeting, do not inquire after each other's health, but after their claims. They do not remark about the weather, bad as it is, but about out-croppings, assays, sulphurets, etc. They do not extend their hands in token of friendship on approaching but pluck from their well filled pockets a bit of rock and, presenting it, mutually inquire what they think of its looks. During the day they stand apart, talking in couples, pointing mysteriously hither and yon; and during the night mutter in their sleep of claims and dips and strikes, showing that their broken thoughts are still occupied with the all absorbing subject. I shall be able to convey to your readers some idea of the intensity of this mining mania when I assure them that this portion of the American people do not even ask after newspapers, nor engage in the discussion of politics. Little care they whom you choose President; conventions and elections, wars and rumors of wars, are nothing to them. They have their own world here. Here, bounded by the Sierras and the mountains of Utah, spread over the foothills and the deserts, is a theatre beyond which their thoughts are not permitted to roam; to this their aspirations and aims are all confined. Whatever of energy, ambition, and desire are elsewhere expended on love, war, politics, and religion are here all devoted to this single pursuit of finding, buying, selling, and trading in mines of silver and gold. Everybody makes haste to be rich; and so great is the mental tension in this direction that it may well be questioned whether, if a sweeping disappointment should overtake them, many will not be reduced to a condition of absolute lunacy.

Concerning the condition of affairs in Humboldt County in the sixties, Browne and Taylor[6] wrote as follows:

Owing to the careless manner in which many of the claims were located, the obscurity and imperfection of the laws, and the still more imperfect manner in which they were enforced, a majority of all the titles, more particularly those to what were considered the better class of mines, became involved in litigation, thereby retarding their development and destroying confidence

6/ Work cited, footnote 5.

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in them generally. Millions of feet[1] of unprospected ledges were sold, sometimes fairly but oftener through misrepresentation and chicanery, and the proceeds, amounting in the aggregate to vast sums, were spent usually in every manner of extravagance and folly and rarely in any persistent and well-directed efforts at opening the mines. Towns were built, hotels and saloons of luxurious style were erected, real estate in these embryo cities went up to enormous prices, everybody seeking to get rich from speculating in city lots or "feet", as these mining properties were designated, but little being done meantime towards advancing the business that should have first been looked after - the opening up and proving of the mines. Mills were also procured and put up at heavy expense before it had been ascertained that enough ores could be had to keep them running, this latter mistake not having been committed to the same extent in Humboldt, as in Esmeralda and some parts of the Reese River regions, where more than two-thirds of the mills have remained constantly idle from the causes set forth. It is also true that an equal proportion of the entire number of mills put up in Humboldt have been doing nothing much of the time; the principal advantage being that only a small number of mills, and these mostly of an inexpensive kind, were erected.

In the sixties several smelters were erected along the Humboldt River and at least sixteen mills were built in the various districts of the county. Many of the mills operated only for a short time, either because of lack of ore or because of the metallurgical difficulties encountered in the treatment of base ores.

The Humboldt Canal scheme was designed to take water from the Humboldt River for use in generating power for mining and to irrigate land along the line of the canal. This scheme was projected in 1862 by an incorporated company with a central office in San Francisco. Mill City was started up with the intention of making it a milling and reduction center but the canal never was built to that place. About $100,000 was spent in constructing the canal to Winnemucca and, as originally designed, it was to have been 90 miles long, 15 feet wide, and 3 feet deep.

Most of these early mines reached the zenith of their production before the Central Pacific Railroad (now Southern Pacific Railroad) was completed across the State on May 10, 1869. Prior to that date, mining supplies and machinery were hauled by wagon team from Marysville or Sacramento, Calif. Railroad communication did not improve mining facilities sufficiently to offset the decrease in the grade of the ore, so that mining activity gradually declined.

1/ In the early days of the West the miners made their locations in feet, and the number of feet each miner could own was governed by the regulations in each district. According to the Statutes of the State of Nevada, approved Feb. 27, 1866, no person was entitled to hold more than 200 feet on any one vein, except the discoverer, who was entitled to 200 feet additional by virtue of the discovery.
The present law under which mining rights are acquired on the public mineral domain was passed by Congress on May 10, 1872.

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A revival in activity occurred from 1879 to 1890, when rich silver veins in the Paradise Valley district were exploited.

The most prominent discovery in the area now included in Humboldt County was the extraordinarily rich gold-silver deposits in the National district. The first discovery was made in 1907, and the deposits were worked intensively for a number of years.

In recent years Humboldt County has attracted considerable attention because of the discovery of the Jumbo mine in the Awakening district made by G. C. Stagg and Clyde Taylor in 1935. This discovery caused a revival of activity in many of the old districts in the county, some of which have been idle for many years.

Mineral Production

The annual production of gold and silver in Humboldt County from 1870 to 1903[8], as compiled from the quarterly rolls of the County assessors, is shown in table 1. From 1870 to 1889, inclusive, 158,537 tons of ore were mined, having a net value of $4,314,697.37, an average of $27.22 per ton. From 1872 to 1885, inclusive, 106,871 tons of tailings were treated, having a net value of $660,674.56, an average of $6.18 per ton. The annual production of the principal metals from 1903 to 1936, according to Bureau of Mines statistics, is shown in table 2. It should be mentioned that the major part of the tabulated production prior to 1918 was derived from mines in what is now Pershing County.

Other minerals that have been produced in the area now included in Humboldt County are arsenic ore (about 100 tons), antimony ore (about 100 tons), manganese ore (about 200 tons), and quicksilver (not more than 100 flasks). In the industrial mineral group, sulphur has been the principal product, but no accurate statistics are available as to the amount. Judging from the tailings and the extent of the underground workings at the sulphur mines near Sulphur, Nev., the total production is roughly estimated at 40,000 tons of sulphur. About 500 tons of crude alunite also have been shipped for use as fertilizer. Opals for gem purposes have been mined in the Virgin Valley opal fields in the northwestern part of the county.

The writer estimates that in June 1937, 170 men were employed directly in the mining industries of the county.

8/ Stuart, E. E., Nevada's Mineral Resources: State Printing Office, Carson City, Nev., 1909, pp. 125-126.

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TABLE 1. - Annual production of gold and silver in Humboldt County, 1870 to 1903

[Compiled from quarterly assessment rolls of County assessors]

Year	Tons ore	Value gold and silver	Tons tailings	Value gold and silver	Total value
1870	7,934	$ 378,840.90	-	-	$ 378,840.90
1871	20,168	499,458.38	-	-	499,458.38
1872	6,233	254,618.07	9,150	$96,921.86	351,539.93
1873	8,356	280,548.02	14,096	111,283.40	391,831.42
1874	7,440	213,644.45	8,360	50,759.75	264,404.20
1875	6,832	267,879.64	3,910	22,044.41	289,924.05
1876	2,607	120,863.04	13,851	90,083.64	210,946.68
1877	6,184	212,260.50	14,730	79,395.21	291,655.71
1878	6,138	186,237.31	19,775	93,537.50	279,774.81
1879	7,872	245,798.86	5,790	27,422.00	273,220.86
1880	14,100	373,467.40	6,918	39,249.37	412,716.77
1881	5,448	74,920.05	5,833	20,170.15	95,090.20
1882	4,255	42,018.02	2,180	9,510.00	51,528.02
1883	5,813	59,501.17	258	1,290.00	60,791.17
1884	10,696	256,066.52	838	10,107.44	266,173.96
1885	11,624	226,146.32	1,182	8,899.83	235,046.15
1886	13,503	342,971.96	-	-	342,971.96
1887	7,159	191,760.14	-	-	191,760.14
1888	2,957	43,366.29	-	-	43,366.29
1889	3,218	44,330.33	-	-	44,330.33
Totals	158,537	4,314,697.37	106,871	660,674.56	
		Value of gold		Value of silver	
1890		10,000.00		$ 90,000.00	100,000.00
1891		3,000.00		37,000.00	40,000.00
1892		15,000.00		20,000.00	35,000.00
1893		13,000.00		12,000.00	25,000.00
1894 1/		1/		1/	1/
1895		41,220.00		122,420.00	163,640.00
1896		31,800.00		22,640.00	54,440.00
1897		142,583.00		4,280.00	146,863.00
1898		85,197.00		15,926.00	101,123.00
1899		33,000.00		18,000.00	51,000.00
1900		73,230.00		80,551.00	153,781.00
1901		74,930.00		77,118.00	152,048.00
1902		62,208.82		80,105.92	142,314.74
1903		70,695.43		82,105.83	152,801.26
Totals		655,869.25		662,146.75	6,293,387.93

1/ Production figures for the year 1894 are not given in the table by Stuart, work cited, pp. 125-126.

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TABLE 2. - Metal production Humboldt County, 1903-36

Year	Gold				Silver (lode and placer)	
	Lode		Placer			
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
1903.....	-----	$34,231	-----	$40,000	-----	$6,562
1904.....	-----	53,785	-----	12,388	-----	5,725
1905.....	1,897.07	39,216	-----	-----	5,864	3,542
1906.....	532.61	11,010	241.83	5,000	9,030	6,050
1907.....	2,983.00	61,664	-----	-----	31,488	20,782
1908.....	13,202.85	272,927	14.51	300	39,552	20,963
1909.....	18,404.95	380,464	16.69	345	80,639	41,932
1910.....	70,443.09	1,456,188	111.17	2,298	280,632	151,541
1911.....	58,941.75	1,218,434	255.42	5,280	255,367	135,345
1912.....	44,746.50	924,992	134.81	2,787	134,193	82,529
1913.....	14,785.62	305,646	623.94	12,898	757,505	457,533
1914.....	25,036.29	517,546	2,222.30	45,939	691,778	382,553
1915.....	38,724.53	800,507	427.44	8,836	740,560	375,464
1916.....	18,917.38	391,057	347.04	7,174	869,424	572,081
1917.....	11,873.11	245,439	58.34	1,206	859,837	708,506
1918 1/....	12,137.09	250,896	44.94	929	869,662	869,662
1919.....	734.48	15,183	43.34	896	10,142	11,359
1920.....	1,318.26	27,251	26.03	538	14,102	15,371
1921.....	1,069.81	22,115	24.09	498	21,476	21,476
1922.....	506.39	10,468	13.16	272	18,593	13,593
1923.....	592.79	12,254	-----	-----	24,200	19,844
1924.....	1,706.72	35,281	31.20	645	35,254	23,620
1925.....	423.23	8,749	3.53	73	9,945	6,902
1926.....	90.75	1,876	35.75	739	7,749	4,835
1927.....	170.81	3,531	16.30	337	10,806	6,127
1928.....	1,058.06	21,872	13.88	287	20,378	11,921
1929.....	1,297.69	26,826	-----	-----	40,194	21,423
1930.....	132.55	2,740	13.30	275	199	76
1931.....	699.79	14,466	16.69	345	1,023	297
1932.....	825.60	17,067	74.61	1,542	10,533	2,970
1933.....	1,132.08	23,402	84.66	1,750	6,137	2,148
1934.....	1,785.03	62,387	46.58	1,628	18,469	11,940
1935.....	6,009.16	210,321	121.74	4,261	88,996	63,966
1936.....	9,482.00	331,870	177.00	6,195	92,127	71,352
	361,661.04	7,881,661	5,240.34	165,661	6,055,854	4,154,990

1/ In 1918 Humboldt County was divided and Pershing County created.

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Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1903.....	----	----	----	----	----	----	$80,793
1904.....	----	----	----	----	----	----	71,898
1905.....	----	----	----	----	----	----	42,758
1906.....	518	$100	16,250	$926	----	----	23,086
1907.....	118,793	23,759	58,880	3,121	19,046	$1,124	110,450
1908.....	54,598	7,207	38,024	1,597	----	----	302,994
1909.....	5,477	712	60,488	2,601	----	----	426,054
1910.....	7,182	912	107,063	4,711	----	----	1,615,650
1911.....	11,979	1,497	71,850	3,233	----	----	1,363,789
1912.....	40,731	6,721	67,590	3,042	----	----	1,020,071
1913.....	17,065	2,645	61,072	2,687	----	----	781,409
1914.....	32,952	4,383	32,495	1,267	----	----	951,688
1915.....	51,362	8,988	101,088	4,751	----	----	1,198,546
1916.....	135,180	33,254	75,734	5,226	----	----	1,008,792
1917.....	567,610	154,958	511,221	43,965	----	----	1,154,074
1918 1/....	249,271	61,570	255,186	13,118	----	----	1,201,175
1919.....	7,223	1,344	35,455	1,879	----	----	30,661
1920.....	8,801	1,619	28,034	2,243	1,700	137	47,159
1921.....	457	59	3,245	146	----	----	44,294
1922.....	725	98	26,363	1,450	----	----	30,881
1923.....	1,403	206	12,815	897	----	----	33,201
1924.....	354	46	4,696	376	----	----	59,968
1925.....	36	5	2,560	223	----	----	15,952
1926.....	30	4	24,445	1,956	----	----	9,410
1927.....	595	78	5,854	369	----	----	10,442
1928.....	989	142	6,785	394	1,248	76	34,692
1929.....	23,539	4,143	7,076	446	----	----	52,838
1930.....	5,855	761	1,900	95	----	----	3,947
1931.....	8,105	738	----	----	----	----	15,846
1932.....	1,205	76	2,564	77	----	----	21,732
1933.....	125	8	6,020	223	----	----	27,531
1934.....	3,366	269	14,883	551	----	----	76,775
1935.....	1,440	120	17,486	699	----	----	279,367
1936.....	2,000	184	48,000	2,208	----	----	411,809
	1,358,966	316,606	1,705,122	109,477	21,994	1,337	12,559,732

1/ In 1918 Humboldt County was divided and Pershing County created.

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AWAKENING DISTRICT

The Awakening, also known as the Amos, district is in the Slumbering Hills about 45 miles by road northwest of Winnemucca, Nev. It is also accessible from Jungo, Nev., a station on the Western Pacific Railroad 35 miles to the southwest. The road via Jungo is in poor condition and at certain times of the year almost impassable by automobile. Mining activity began in this area about 1910 with the discovery of the Alabama mine by Murray Scott. An intermittent production of gold-silver ore has been made by H. C. Davey and others from the Mayday, Alabama, and other properties on the east side of the Slumbering Hills. A 5-stamp amalgamation mill erected at Daveytown some years ago treated about 10,000 tons of ore, judging from the tailings pond near the millsite. The discovery of the Jumbo mine by G. C. Staggs and Clyde Taylor on the western side of the Slumbering Hills on Feb. 5, 1935 caused considerable excitement, and a large number of claims were located. In 1936 and 1937 a number of small companies were organized to prospect in this area, but, with the exception of the Jumbo mine, no outstanding discoveries had been made up to the time of the writer's visit in June 1937.

In the past two years the bulk of the production from the district has been derived from the Jumbo mine.

Jumbo Mine

The Jumbo mine comprises four unpatented claims on the east side and near the crest of the Slumbering Hills. It was sold in 1935, the year it was discovered, to George Austin and associates, of Jungo, Nev., for $10,000. It is interesting to note that the property was equipped and paid for out of proceeds derived from the mine. In 1935 Austin and associates equipped the property with a small amalgamation mill, in which a small tonnage of high-grade ore obtained by screening was treated. In 1936 a 30-ton amalgamation-concentration mill was erected. During the first five months of 1937, 1,086 tons of ore were treated, having a gross value of $21,735. In May 1937 the property was sold to J. K. Wadley, Sherman Hunt, and H. L. Hunt, oil operators from Texas, under a bond and lease agreement with a reported cash payment of $250,000. When the writer visited the property in June 1937, the mill was treating 38 tons of ore per day averaging $30 per ton and was employing an average of 15 men.

The formation consists of metamorphosed sediments, principally shale, dipping from 55° to 70° to the east. Gold alloyed with silver occurs in the free milling state in numerous stringers in the shale. The stringers are in part filled with the vein-forming feldspar and adularia, and a notable feature of the deposit is the small amount of silicification.

Development consists of 6 adits with an aggregate length of about 1,000 feet. Mine equipment includes a portable Gardner-Denver compressor, tractor, and scraper and mining tools. The mill is on the edge of the Black Rock Desert 3 1/2 miles from the mine. It was designed for a

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capacity of 25 tons per day, but, due to the softness of the ore, the maximum capacity is 38 tons. Mill equipment includes a jaw-crusher (8 by 10 inches), a Marcy ball mill (42 inches by 5 feet) in closed circuit with a Dorr simplex classifier, a Clark-Todd amalgamator between the ball mill and the classifier, an amalgamation plate, and a Wilfley concentrating table. Power for milling is furnished by a Diesel-powered electric generator and electric motor-driven units.

BOTTLE CREEK DISTRICT

The Bottle Creek district is on the east slope of the Jackson Mountains 65 miles by road northwest of Winnemucca, the nearest shipping point and supply center. In September 1936 cinnabar was discovered by the Scossa brothers, James and Arnold, of Winnemucca in the foothills of the Jackson Range about 3 1/2 miles northwest of lower Bottle Creek ranch. Shortly after this discovery a large number of locations were made, but most of the work has been confined to the Red Ore and White Peak groups of claims owned by the Scossa brothers. In July 1937 the Scossa claims were sold to John A. Fulton, of Reno, and associates. No production of quicksilver had been made up to the time of the writer's visit.

Red Ore and White Peak Groups

The Red Ore group comprises four unpatented claims and two fractions and the White Peak group three unpatented claims. These two groups of claims are separated by other holdings. Cinnabar was first discovered in the form of float, and the sources of the float were traced by panning. Placer nuggets of cinnabar up to 3 inches in diameter have been found on bedrock in a layer of coarse, well-rounded gravel about 18 inches thick covered with fine sand and detrital material ranging in thickness from a few feet to probably 60 feet.

Development work on the cinnabar deposits consist of three shallow shafts, the deepest of which is 30 feet, and several short adits and surface trenches, totaling, in all, about 200 feet of workings. This work was done by hand methods. At the time of the writer's visit the only equipment on the property was a small gasoline hoist and camp accommodations for four men.

The cinnabar occurs as seams and as disseminations in a highly altered and fractured andesite and rhyolite. Samples of the ore show values ranging from 1/2 to 3 1/2 percent quicksilver. With the small amount of development work done, the showings are encouraging and the outlook for the area appears promising.

CENTRAL DISTRICT

The Central district is in the northern part of the Eugene Mountains on the Humboldt-Pershing County boundary. It is sometimes divided into the New Central district on the north and the Central district on the south. Pronto, a station on the Western Pacific Railroad, is about 8 miles to the

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northeast. The Central district was organized in 1861; in 1869 a 2-stamp mill was erected on the Golden Age property and was operated for a short time. In 1372 a 4-stamp mill and a Stedtefelt furnace were erected in this area, but this plant soon shut down because of litigation; it was destroyed by fire in 1376. Subsequently, small lots of ores were treated at the Wise reduction plant at Winnemucca and at the Clark mill on the Humboldt River. Both of these plants were small affairs and operated largely on custom ores. The production of precious metals from this district in the early days is not available, but in all probability the amount was not large. In recent years the district has been intermittently active; most of the activities being attributable to lessees who have made occassional carload shipments of ores to Utah smelters.

Golden Eagle Property

The Golden Eagle property comprises three unpatented and two patented claims owned by E. J. Baker and associates. The property was last active in 1935, when lessees produced a small quantity of shipping ore obtained by screening the dumps. Development consists of several adits and other workings, totaling in all about 1,500 feet. There is no mining equipment on the property.

The formation consists of shale and limestone. The principal vein is about 1 1/2 feet wide with a nearly vertical dip. The gangue is chiefly quartz carrying gold and silver and a small amount of lead.

King Midas Group

The King Midas group of five unpatented claims, owned by Walter F. Fisk, of Winnemucca, Nev., is 1/2 mile south of the Golden Eagle property. In June 1937 the property was under lease to R. W. Dougharity, who was prospecting the ground with his two sons.

Development consists of several shallow shafts, a number of short adits, and scattered surface workings totaling about 500 feet. There is no equipment on the property and mining is done by hand methods. The water available in the vicinity contains a considerable amount of arsenic and is unfit for domestic purposes. Water for domestic use is hauled from Pronto. Several narrow veins in shale and granite with variable strike and dip, occur on the property. The gangue is white quartz and the values are in gold and silver with a small amount of lead. In places a considerable amount of arsenic is present either in the form of oxide or arsenopyrite.

Yellow Jacket Group

The Yellow Jacket group of two unpatented claims, owned by S. L. Hershberger, adjoins the King Midas group on the south. These claims formerly were part of the Golden Eagle group. When the writer visited the property in June 1937, Hershberger and his two sons was prospecting the ground. Development consists of six adits, the longest of which is 250 feet, and several shallow shafts, totaling in all about 1,000 feet of workings. Mining is done by hand methods.

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Formation is chiefly granite, and the ore occurs in narrow quartz veins with variable strike and dip. In places the ore contains a considerable amount of arsenic. Values are chiefly in gold and silver.

Marietta Group

The Marietta group of four unpatented claims on the northeast slope of the Eugene Mountains 12 miles south of Pronto is owned by C. F. Keil of Winnemucca, Nev. At the time of the writer's visit the property was under lease and bond to Frank L. McHenery and partner, who were prospecting by hand methods. This is one of the old properties in the district and it produced some shipping ore in the early days.

Development consists of eight short adits, the longest of which is 250 feet, and an inclined shaft 250 feet deep, totaling about 1,000 feet. The ore occurs in narrow quartz veins in rhyolite and shale. Values are in gold and silver.

COLUMBIA DISTRICT

The Columbia district is in the south end of the Pine Forest Range near the northwest end of the Black Rock Desert about 100 miles by road northwest of Winnemucca, the nearest supply center and shipping point. The district was discovered in 1870 by a man named Verry; it was organized as the Columbia district in 1875. The first ores were worked in an arrastra, and in the late seventies two stamp mills were erected to treat ores from the Badger and Independence mines. Each of the mills was equipped with five stamps and an amalgamation pan. One mill was operated by steam and the other one by water power obtained from Bartlett Creek. Only a small tonnage of ore was treated in these mills. Soon after the district was organized, it declined rapidly and never obtained any prominence.

In Baxter Canyon, in the western part of the district, gold was discovered by Clyde Garrett in 1914. Little production was made until 1936, when the claims were acquired by the Columbia Mines Co., Inc. Up to June 1937 this company produced several hundred tons of shipping ore per month.

Columbia Mines Co., Inc.

The Columbia Mines Co., Inc., comprises the Black Rock group of six unpatented claims. E. F. Nieman, of Salt Lake City, Utah, is president and general manager. An average crew of 12 men is employed.

Development work consists of a vertical shaft 100 feet deep, an adit 200 feet long, and other workings totaling about 1,000 feet. Mine equipment consists of a 25-horsepower gasoline hoist, a Gardner-Denver portable compressor, an assay office, and camp accomodations for about 14 men. Water for domestic use is obtained from a well sunk to 90 feet in the canyon near the camp. Because of the base character of the ore, no attempt has ever

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been made to mill the ore locally. The cost of trucking the ore to Winnemucca is $5 per ton when a load of 6 tons is carried per trip. The ore is selectively mined by the open-stope method. Mining cost is $5 per ton. Up to June 1937 production from the property had been 2,000 tons of ore.

The ore occurs in a fissure vein striking east and west and dipping north about 70°. The width of the vein varies from 1 to 5 feet. The formation is diorite and slate. The vein material is chiefly altered and brecciated diorite containing gold as the principal metal, associated with arsenical oxide and sulphide, in places up to 20 percent, and a small amount of copper. The amount of copper increases with the depth. The average grade of the ore mined is 1 ounce gold and 3 ounces silver.

Moose Group

The Moose group of four patented claims owned by J. W. Bartlett and associates is in the Pine Forest range about 3 miles a little east of north of the Bartlett ranch in Baxter Canyon. This property was prospected in the early days for copper, but no production was made. The present owners acquired the claims at a tax sale in 1936.

Development consists of an adit several hundred feet long, partly caved, and an inclined shaft about 65 feet deep. There is no equipment on the property, and at the time of the writer's visit it was idle.

Oxidized copper minerals associated with silver and gold occur in a quartz vein striking northwest and southeast and dipping about 45° to the northeast in an andesite formation. The vein is traceable on the surface for a considerable distance, and its width varies from 6 to 12 feet.

DONNELLY DISTRICT

The Donnelly district is in southwest Humboldt County on the west slope of Donnelly Peak in the Black Rock Range, 47 miles by road a little east of north from Gerlach, Nev., a station on the Western Pacific Railroad and the nearest shipping point. The best road to the mine is via Leadville, Nev. This road turns off the Gerlach-Cedarville road a little north of the Swingle ranch; the distance from Gerlach is 55 miles. The claims in this area are at an altitude of 6,800 to 7,300 feet.

Gold was discovered in 1907 by a cowboy who located several claims, which were sold to James Raser, formerly of Gerlach. Raser shipped a little high-grade ore and in 1911 erected a 5-stamp amalgamation mill, which operated for several years. The Reeder mine south of the Raser property was worked in former years on a small scale by Lem and Joseph Reeder, who produced a small amount of gold bullion in an arrastra. The total production from the area is said to have been about $90,000, most of which was made by James Raser.

When the writer visited the district in June 1937 there was no activity.

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Hermit Group

The Hermit group of six unpatented claims and one fraction, formerly included in the Donnelly and Reeder properties, is owned by J. J. Thrasher and associates of Gerlach, Nev.

Development work consists of eight adits, which, with lateral workings, total about 2,000 feet. Equipment consists of a mill, erected by Raser, and several camp buildings. The mill is equipped with a jaw-crusher (8 by 12 inches), 5-stamp battery (1,050-pound stamps), Diester table, and a 60-horsepower, 1-cylinder, gasoline engine. Mill equipment is in poor condition and of little value. Water for milling and domestic use is available from several springs in the vicinity.

The ore occurs as lenses in narrow veins in granodiorite intruded into slate and quartzite. The principal veins strike northwest and southeast, dipping 30° northeast, and they vary in width from a few inches to a maximum of 2 1/2 feet. The gangue is chiefly iron-stained quartz. The gold is disseminated through the quartz in fine particles associated with a small amount of silver.

DUTCH FLAT DISTRICT

The Dutch Flat, also known as the Florence district, is 18 miles northeast of Winnemucca and 18 miles north of Golconda on the west slope of the Hot Spring range. Placer gold was discovered here in 1893 by Fred.G. Wendel. For several years following the discovery of placer gold about 20 men were employed in working the gravel in rockers, with good results. In the first year production is said to have been $75,000. Water for placer operations was hauled from a well in Spring Canyon, about 1 mile distant. The production of placer gold has been about $100,000.

Wendel Group

The Wendel group of 11 placer claims, owned by Fred G. Wendel, includes nearly all the placer ground in the district. In 1904 a company organized in Salt Lake City, called the Dutch Flat Gold Mining Co., attempted to work the placers with power equipment. Twenty acres sampled by the company are reported to have contained 375,000 cubic yards of gravel averaging 31 cents per cubic yard at the old price of $20.67 per ounce of gold. The average depth of the gravel is 15 feet. Equipment installed consisted of a trommel, sluice, and tailings elevator. The gravel was mined and transported to the machines by dragline scraper. This venture was unsuccessful as the company could not obtain an adequate water supply for the washing plant. In 1909 and 1910 the ground was leased by Wendel and associates to Chinese placer miners. In later years the placer operations have been confined to small-scale activity either by Wendel or lessees. In 1937 this property was optioned to a Reno group.

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The placer area is about 1 1/2 miles long and ranges in width from 300 to 2,000 feet. There is no regular channel wherein the gold is concentrated, and good values have been found on the hillside adjacent to the ravine as well as in the ravine itself. Over 100 shafts have been sunk on the property in former operations. These shafts vary in depth from 6 to 22 feet and average about 12 feet to bedrock. The bedrock is composed of schist, rhyolite, and granite.

The gravels are a mixture of detrital material consisting of angular rock fragments and sand, which in places is cemented with clay. The largest rock fragments are less than 6 inches in diameter. The greatest concentration of gold is on bedrock, the pay streaks varying from 6 inches to 3 1/2 feet thick. Both fine and coarse gold are present. The coarse gold is rough and angular and some of it is attached to a quartz matrix, indicating that it has not traveled far. The largest nugget ever found in the placer had a value of $180. A large amount of black sand and some cinnabar is associated with the gold. The gold has an average fineness of 940.

The exploitation of the placer with power equipment depends largely upon the development of an adequate water supply. Probably water can be obtained from wells sunk in the little Humboldt River Valley, a short distance east of the placer ground. This water would have to be pumped to the placer area.

GOLCONDA DISTRICT

The Golconda district is in the vicinity of Golconda, a station on the Southern Pacific and Western Pacific Railroads. W. C. Gregg made the first locations in this area and organized the district in 1866. Although a considerable number of claims were located in the early days, none of them passed beyond the prospecting stage of development. The Golconda Gold Ledge Mining Co. has been the principal property in this area.

Manganese associated with tungsten was discovered 4 miles east of Golconda in 1885 and prospected for precious metals with discouraging result The only production on the manganese claims is three carloads of manganese ore shipped to San Francisco in 1893 by J. A. Langwith of Winnemucca, and at least one carload shipped in 1918 by the Noble Electric Steel Co.

Golconda Gold Ledge Mining Co.

The Golconda Gold Ledge Mining Co., formerly known as the Golconda Nevada Mining Co. comprises two patented and one unpatented claims 2 miles south of Golconda. The company is controlled by a group from Kansas City, Mo. The last work was done on the property in 1917. According to company records, from 1908 to 1915 13,705 tons of ore were mined having an assay value of $90,749. From this amount of ore, $65,632.33 worth of bullion was recovered, according to mint returns. A large part of the production was made by lessees.

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Development work comprises several adits, the longest of which is 220 feet. Underground workings total approximately 2,000 feet. The only equipment on the property consists of a 20-stamp mill from which all machinery except the stamps and crusher has been removed.

Values are in gold, which is present in oxidized material in a quartzite formation.

Rare Metals Corporation

In 1937 the Rare Metals Corporation acquired six unpatented claims owned by M. C. Bauder and associates and other property in the area.

Development comprises several shallow shafts, a number of open cuts, and several short adits, totaling in all about 700 feet of work. There is no equipment on the property.

Total production of manganese is probably about 200 tons. The manganese deposits are of unusual interest because they contain tungsten, first reported by Penrose9/. The manganese occurs in thin lenses underlain by shale and overlain by a capping of soil and tufa generally not more than a few feet thick. The manganese is composed of soft sooty oxide with streaks and bunches of iron oxides along the margin. A car sample of 30 tons shipped in June 1918 gave the following analyses:

Manganese, 32.5 percent	Iron, 5.2 percent
Silica, 6.2 percent	Phosphorus, 0.056 percent
Tungsten, 1.5 percent	

GOLD RUN DISTRICT

Gold Run (also known as the Adelaide) district is in southeast Humboldt County on the east slope of the Sonoma Range about 12 miles south of Golconda, a station on the Southern Pacific Railroad. The district was organized in 1866, and in 1868 an 8-stamp pan-amalgamation mill was erected in this area to treat ores from the Golconda and Hope mines. In 1889 A. S. Bates and associates made some copper matte at Adelaide which was shipped to New Jersey. In 1897 the Glasgow and Western Exploration Co., controlled by Scotch interests, acquired the principal mines in the district and constructed a 12-mile narrow-gage railroad from Adelaide to Golconda. A concentrating plant and smelter were erected at Golconda. The smelter included two Bruckner roasting furnaces and three small reverbatory smelting furnaces with a combined capacity of 90 tons per day. The smelter started to operate in 1898 and ran fairly continuously until 1905. In 1907 the concentrator was remodeled to employ the Macquisten process. This mill ran for 1 1/2 years, when operations were suspended. In 1911 the Golconda mill and smelter were scrapped.

9/ Penrose, R. A. F., Jr., Manganese, Its Uses, Ores, and Deposits: Arkansas Geol. Survey Ann. Rept. for 1890, vol. 1. p. 470, 1893.
A Pleistocene Manganese Deposit near Golconda, Nev.: Jour. Geol. vol. 1, 1893, pp. 275-282.

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In 1916 the Adelaide mine was purchased by the Yerington Mountain Copper Co., which operated the mine for several years during the War.

In recent years the district has been intermittently active, with a number of small company operations and by lessees. Production from the district from 1907 to 1936 is shown in table 3.

Placer gold was discovered along Gold Run Creek in 1886, and the placers were worked in a desultory manner by small-scale sluicing and rocking for a number of years. In 1901 V. L. Bliss and William Evans acquired the principal placer deposits on Gold Run Creek and built a flume and pipeline. This plant operated for several years. According to A. J. Langwith of Winnemucca, who has been familiar with mining activities in the district since 1890, the total placer production has been about $30,000.

Adelaide Mine

The Adelaide mine comprises a group of five patented claims owned by Humboldt County. The claims were acquired by the county for non-payment of taxes. The bulk of the production in the Adelaide district was derived from this mine during the period when it was operated by the Glasgow and Western Exploration Co.

Development work consists of the main shaft, 300 feet deep, an adit 2,000 feet long, and other workings, totaling about 1 mile in length. The lower portion of the main shaft has been filled with water for a number of years. There is no equipment on the property.

The formation consists of calcareous shale with intercalated beds of limestone. The ore occurs in the limestone layers and is composed chiefly of chalcopyrite, pyrrhotite, a little sphalerite, and galena disseminated in a gangue of calcite, garnet, vesuvianite, and other silicates. Several specimens of ore on the dumps near the main shaft were collected by the writer and showed a little scheelite.

Due to the presence of the heavy gangue minerals in the ore, the attempt to concentrate by gravity method in the early days was not satisfactory. Experimental tests were made also to concentrate the ore by the Blake-Morscher electrostatic process.

The Macquiston-tube process employed by the Glasgow and Western Exploration Co. is interesting in that it was among the first flotation plants to be erected in the United States. The process was patented in 1904 by A. P. S. Macquisten.

A description of this ingenious process is given by Ingalls[10/]. No chemical or physical agents were used except ordinary crushing, and the sulphide minerals were floated on water while the quartz and other gangue minerals sank to the bottom. The weak part of the process was the difficulty encountered in recovering the minerals from the slime. The capacity of the Golconda plant was 125 tons per day.

10/ Ingalls, W. R., Concentration Upside Down: Eng. & Min. Jour., vol. 84, 1907, pp. 765-770.

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TABLE 3. - Gold, silver, copper, lead, and zinc production from Gold Run (Adelaide) District, Humboldt County, Nev., 1907-36

(Compiled by Charles White Merrill, Mineral Production and Economics Division, Bureau of Mines)

Year	Placer						Lode			
	No. of mines	Gold		Silver		Total value	No. of mines	Ore	Gold	
		Fine ounces	Value	Fine ounces	Value			Short tons	Fine ounces	Value
1907...	—	—	—	—	—	—	—	44	1.98	$41
1908...	—	—	—	—	—	—	3	118	67.96	1,405
1909...	—	—	—	—	—	—	10	1,863	952.89	19,698
1910...	—	—	—	—	—	—	2	15	2.37	49
1911...	—	—	—	—	—	—	8	153	126.99	2,625
1912...	—	—	—	—	—	—	2	2,461	554.10	11,454
1913...	—	—	—	—	—	—	5	3,282	1,016.30	21,009
1914...	1	5.00	$103	—	—	$103	2	1,577	471.16	9,740
1915...	1	3.31	68	1	$1	69	12	763	125.13	2,587
1916...	1	2.09	43	1	1	44	12	1,751	60.80	1,257
1917...	1	3.60	74	—	—	74	17	7,116	126.92	2,624
1918...	1	12.50	258	2	2	260	3	716	10.03	207
1919...	1	43.34	896	8	9	905	4	70	6.81	141
1920...	1	2.00	41	—	—	41	5	14,347	5,052.35	104,441
1921...	1	24.08	498	4	4	502	2	30	87.00	1,798
1922...	—	—	—	—	—	—	3	55	6.64	137
1923...	—	—	—	—	—	—	6	84	12.04	249
1924...	2	31.19	645	2	1	646	2	76	4.96	103
1925...	1	3.52	73	1	1	74	1	3	.40	8
1926...	—	—	—	—	—	—	4	44	6.33	131
1927...	1	6.64	137	—	—	137	2	5	1.03	21
1928...	—	—	—	—	—	—	2	26	3.11	64
1929...	—	—	—	—	—	—	3	66	18.32	379
1930...	—	—	—	—	—	—	2	38	1.00	21
1931...	—	—	—	—	—	—	—	—	—	—
1932...	2	21.63	447	3	1	448	—	—	—	—
1933...	1	22.44	574	4	1	575	1	14	22.00	562
1934...	—	—	—	—	—	—	3	107	62.84	2,196
1935...	6	41.99	1,470	6	4	1,474	3	43	8.26	289
1936...	2	23.32	816	3	2	818	5	72	163.55	5,724
	—	246.65	6,143	35	27	6,170	—	34,939	8,973.27	188,960

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TABLE 3. - Gold, silver, copper, lead, and zinc production from Gold Run (Adelaide) District, Humboldt County, Nev., 1907-36 - Continued

(Compiled by Charles White Merrill, Mineral Production and Economics Division, Bureau of Mines)

Year	Lode										Total value, lode and placer
	Silver		Copper		Lead		Zinc		Total value	Average recoverable value of ore per ton[1]	
	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value			
1907..	1,266	$836	——	——	14,143	$750	——	——	$1,627	$36.98	$1,627
1908..	3,297	1,747	——	——	35,905	1,508	——	——	4,660	39.49	4,660
1909..	5,886	3,061	4,485	$583	54,000	2,322	——	——	25,664	13.78	25,664
1910..	926	500	——	——	13,233	582	——	——	1,131	75.40	1,131
1911..	3,256	1,726	10,209	1,276	24,727	1,113	——	——	6,740	44.05	6,740
1912..	491	302	——	——	3,376	152	——	——	11,908	48.39	11,908
1913..	1,877	1,134	121	19	20,870	918	——	——	23,080	7.03	23,080
1914..	4,629	2,560	30,861	4,105	——	——	——	——	16,405	10.40	16,508
1915..	2,720	1,379	38,416	6,723	32,584	1,531	——	——	12,220	16.02	12,289
1916..	4,902	3,226	107,941	26,553	22,313	1,540	——	——	32,576	18.60	32,620
1917..	28,331	23,345	488,760	133,431	42,725	3,674	——	——	163,074	22.92	163,148
1918..	4,085	4,085	64,434	15,915	——	——	——	——	20,207	28.22	20,467
1919..	1,838	2,059	7,223	1,343	34,086	1,806	——	——	5,349	76.41	6,254
1920..	94,109	102,579	——	——	——	——	——	——	207,020	14.43	207,061
1921..	2,224	2,224	——	——	——	——	——	——	4,022	134.07	4,524
1922..	2,941	2,941	——	——	3,291	181	——	——	3,259	59.25	3,259
1923..	2,498	2,048	85	13	11,009	771	——	——	3,081	36.08	3,081
1924..	865	580	——	——	——	——	——	——	683	8.99	1,329
1925..	89	62	——	——	971	84	——	——	154	51.33	228
1926..	2,358	1,471	——	——	22,026	1,762	——	——	3,364	76.45	3,364
1927..	214	121	——	——	3,753	236	——	——	378	75.60	515
1928..	383	224	96	14	4,378	254	1,248	$76	632	24.31	632
1929..	2,025	1,079	——	——	707	45	——	——	1,503	22.77	1,503
1930..	152	59	5,855	761	1,900	95	——	——	936	24.63	936
1931..	——	——	——	——	——	——	——	——	——	——	——
1932..	——	——	——	——	——	——	——	——	——	——	448
1933..	28	10	——	——	——	——	——	——	572	40.86	1,147
1934..	717	464	318	25	6,257	232	——	——	2,917	27.26	2,917
1935..	1,465	1,053	——	——	12,753	510	——	——	1,852	43.07	3,326
1936..	499	386	——	——	2,342	108	——	——	6,218	86.36	7,036
	174,071	161,261	758,804	190,761	367,349	20,174	1,248	76	561,232	16.06	567,402

1/ Not to be confused with average assay value of ore.

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Crown Mine Group

The Crown Mine group of 16 unpatented claims is on the east slope of the Sonoma Range, about 12 miles south of Golconda, Nev. Although this property was located many years ago, little work was done until 1920, when it was acquired by the W. P. Hammon interests of California, who carried on an extensive development campaign for several years but made no production. In 1925 the property was acquired by E. F. Knudsen on a labor lien, and in 1933 it was acquired by a Reno group. In June 1937 the property was inactive.

Development consists of several shafts, the deepest of which is 430 feet; several adits, the longest of which is 600 feet; and other workings, totaling approximately 8,000 feet. All the workings are in the oxidized zone. Equipment includes an Ingersoll-Rand drill sharpener, a Sullivan compressor (16 by 9 3/4 by 12 inches) belt-connected to 50-horsepower motor, a Venn-Severin oil engine belt-connected to an alternating-current generator, and mining tools. There are camp buildings on the property sufficient to house a crew of 30 men.

The formation consists of quartzite, shale, and schist. Several veins occur on the property, the principal one being known as the Crown vein. This vein has a strike of nearly north and south, a dip of 70° westerly, and a width ranging from 10 to 80 feet. Values are in gold and silver in a brecciated quartz gangue stained with iron and manganese oxides. Several ore bodies have been developed on the Crown vein and, according to the sampling results of several engineers, at least 200,000 tons of ore averaging between $4 and $5 per ton (present metal prices) have been blocked out.

Metallurgical tests show that the ore is amenable to the cyanide process. Water for milling is available from the mine workings. According to the reports of former operations, the mine flow amounted to 300 gallons per minute.

HARMONY DISTRICT

The Harmony district is in Harmony Canyon in the north end of the Sonoma Range, 5 miles southeast of Winnemucca. According to Stretch[11], the first locations were made in this area in 1863 by M. Milleson and party, but there is no record of any production. The Wolverine-Red Rose group of claims in this area was owned formerly by the Nevada Harmony Mines Co. This company did considerable development work in 1918 but made no production. The only production from the district has been 3 1/2 carloads, averaging $23 per ton, of copper ore carrying gold and silver values, shipped by Wolverine Copper Company in 1915.

11/ Stretch, Richard H., Annual Report of the State Mineralogist of the State of Nevada for 1866: Carson City, 1867, p. 54.

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Wolverine-Red Rose Group

The Wolverine-Red Rose group comprises six unpatented claims owned by G. B. Williams and associates of Reno, Nev.

Development comprises six adits and two shafts totaling about 2,000 feet of workings. The main shaft is 245 feet deep, inclined 52°, with levels at 100- and 200-foot intervals. Most of the development work was done by the Nevada Harmony Mines Co. in 1918. This company passed out of existence in 1929. According to Williams, exploration work was handicapped considerably by the large flows of water encountered. Equipment on the property includes a 60-horsepower, Venn-Severin, 1-cylinder oil engine belt-connected to an Ingersoll-Rand compressor (12 by 10 inches), a blacksmith shop, and several camp buildings in a state of disrepair.

The main shaft workings are in limestone and shale. The adits on the Red Rose claim south of the shaft are in rhyolite and quartzite. Oxidized and sulphide copper minerals with associated gold and silver occur in a series of at least three veins from 4 to 7 feet wide with a general north and south strike and dipping from 50° to 80° east. The gangue is principally quartz, calcite, and country rock.

IRON POINT DISTRICT

The Iron Point district is in a range of low hills at the south end of the Osgood Range 12 miles by road east of Golconda, Nev. It is accessible by automobile by turning north off Highway 40 at a point 9 1/2 miles southwest of Golconda. The nearest shipping point is Iron Point, a station on the Southern Pacific Railroad about 4 miles south. Although several claims were located here in the early days and some prospecting work was done, there is no record of any production until 1918, when silver ore was discovered by L. K. Kramer. The production of the district, chiefly from the Silver Coin group of claims located by Kramer, has been about $25,000. All ores produced were shipped to smelters for treatment. There is no water available in the immediate vicinity. When the writer visited the area in June 1937 there was no activity.

Silver Coin Group

The Silver Coin group of five unpatented claims is owned by the Kramer Estate, Lyle L. Kramer, of Golconda, Nev., administrator. According to the records in possession of Kramer, the production of shipping ore from 1918 to 1924 by Kramer and lessees was 25 lots, totaling 693.5 dry tons containing 30,854 ounces of silver, or an average of 44.49 ounces per ton. The ore also contained a little lead and about 0.02 ounce gold per ton.

Development consists of a number of shallow shafts, open cuts, and surface trenches totaling approximately 1,200 feet. The principal working is the Silver Coin shaft inclined about 30° and 165 feet deep. There is no equipment on the property.

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The formations are silicified limestone and black shale intruded by andesite. The vein strikes north 15° east and dips 32° to the west, averaging 3 feet in width. The width of the shipping ore averagedabout 20 inches. The principal economic mineral in the ore is silver occurring in cerargyrite, argentite, and tetrahedrite, associated with cerussite and oxidized copper minerals.

Kramer Silver King Mining Co.

The property of the Kramer Silver King Mining Co. comprises a group of 5 patented claims owned by a small stock company controlled by a group from Kansas City, Mo. Only a small amount of development work has been done on the property and there is no record of any production. There is no equipment on the property.

LEONARD CREEK DISTRICT

The Leonard Creek placer district is in northwest Humboldt County at the south end of the Pine Forest Range, 95 miles by road northwest of Winnemucca, Nev., which is the nearest railroad and supply center.

The first discovery of placer gold was made in 1914 by Lee Curry. The placers in this area have been intermittently worked by sluices and rockers. No accurate figures are available on the amount of placer gold produced, but, according to Curry and Alley, the production has been about $5,000. When the writer visited the district in June 1937 there was very little placer activity in the district.

Mattinson Placer

The Mattinson Placer, owned by R. D. and J. E. Mattinson of Leonard Creek, Nev., covers 2,300 acres of unpatented ground on and above Leonard Creek, a short distance above the Leonard Creek Ranch. In 1937 the Mattinson brothers installed power equipment to work the placer. The equipment consists of a 1/2-cubic yard capacity Sauerman dragline scraper operated by a Fordson-Allison dragline unit, a trommel, and sluice box. The trommel is 8 feet long and 4 feet in diameter, driven by a Dodge automobile engine. The first 5-foot section of the trommel is covered with a steel plate, on the inside of which are three sets of spiral blades for washing and disintegrating the material. The other 3 feet of the trommel is covered with 1/2-inch woven-wire screen. The screen oversize is rejected as waste and the undersize passes through a steel sluice box 40 feet long, 14 inches wide, and 8 inches high equipped with Hungarian riffles. Capacity of the machine is 150 cubic yards in 8 hours. When the writer visited the property 1,500 cubic yards of gravel had been treated and the recovery averaged 78 1/2 cents per cubic yard in gold. Water for washing and sluicing is pumped from a well 300 feet deep located 200 feet from the washing plant. Water consumption is 60 gallons per minute.

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The width of the placer channels varies from 800 feet at the lower end to 1,500 feet to the upper end. At the lower end of the property three shafts averaging 33 feet deep have been sunk to bedrock, and the material excavated in sinking these shafts averaged 29 1/2 cents per cubic yard. At least 10 other shafts have been sunk along the lower portion of the channel for a distance of 2 miles, and the values are reported to range from 15 cents to $3.85 per cubic yard. The average depth of the gravel in the lower part of the property is about 18 feet.

The upper portion of the property consists of a large flat area. Two shafts 21 and 55 feet deep, respectively, gave an average value of 20 cents per cubic yard. These shafts were not sunk to bedrock, as operations were hampered by the flow of water encountered. The depth to bedrock in this area is probably about 100 feet, as indicated by a drill hole.

The alluvium is chiefly sand, gravel, and a little clay, with a few large boulders on the surface. The values are distributed through the gravel from surface to bedrock, which is a soft tufa. The gold is rough, sharp, and fairly coarse, occassional nuggets having values up to $5 or $6. The average fineness of the gold is 903.

Basin Placer

The Basin Placer comprises 40 acres near the upper end of Leonard Creek owned by Arthur Alley and Lee Curry. In 1937 this property was under lease to Paul A. Tarpy and associates, of Oakland, Calif. This ground has been worked on a small scale by sluicing and rocking when snow water was available. The placer has been sampled by 33 shafts, but the results of the sampling are not available. The depth of the gravel ranges from 2 to 24 feet and averages about 12 feet. Three wells have been sunk on the ground for water and the combined flow is said to be about 200 gallons per minute. A nugget valued at $41.60 was found on this ground.

Montero Placer

Potential placer ground is included in the Montero ranch owned by Ramon Montero of Leonard Creek. The ranch comprises 5,500 acres. No placer gold has been produced from this property and very little prospecting has been done.

The water rights on the Leonard Creek watershed is owned by Ramon Montero, and during the dryest part of the year the surface flow is estimated to be 800 gallons per minute. During the spring run-off the flow may attain a maximum of 12,000 gallons per minute.

McDERMITT DISTRICT

The McDermitt district is in the vicinity of the town of McDermitt on the Oregon-Nevada boundary line, 77 miles north of Winnemucca, which is the nearest railroad point. Cinnabar was discovered in a range of low hills

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13 miles, by road, southwest of McDermitt in 1931, by Gamos Alcorto and Euserbio Agnarez of McDermitt, Nev. Shortly after, the Cordero group of claims located by the discoverers was leased to the Bradley interests of San Francisco, but the lease was relinquished in 1933.

When the writer visited the area in June 1937 there was no activity.

Cordero Group

The Cordero group comprises five unpatented claims. Development consists of an inclined shaft 75 feet deep and lateral workings totaling about 1,000 feet. There is no mining equipment on the property. In 1933, after the Bradley interests had ceased operations, the owners produced about 68 tons of sorted ore, which was retorted at the Opalite quicksilver mine in Oregon, 23 miles west of McDermitt. According to Agnarez, 42 flasks of quicksilver were produced from this ore. This is the only production.

The cinnabar occurs disseminated in an opalite formation considerably broken by faulting.

NATIONAL DISTRICT

The National district is in northeastern Humboldt County on the west slope of the Santa Rosa Range, 18 miles by road southeast of McDermitt, Nev., and 77 miles a little east of north from Winnemucca, the nearest railroad point and supply center. The mines in the vicinity of Buckskin Peak, about 3 miles southeast of the camp of National, are usually considered part of the district. The district was discovered by J. L. Workman and Lew Davis in June 1907, who located virtually all the properties in the camp, comprising 34 claims. The following year Workman purchased Davis's interests in the ground and divided it into lease blocks several hundred feet square. Leases were granted for a one-year period, and the sliding-scale system of royalty payments adopted was as follows:

Assay value per ton	Royalty, percent
$50 or less	10
$50 to $150	15
$150 to $250	20
$250 to $1,000	25
$1,000 or more	40

Rich ore was found in 1909 in the Combination lease owned by the Stall brothers, Frank and George; the first ore shipped from this lease is reported to have averaged $19.90 per pound. While this lease was active, an option on the property was obtained from Workman by Sam Gundaker and associates, who organized the National Mining Co. A one-year extension of the Stall lease contract had also been given by Workman to the Stall brothers,

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and with the discovery of the rich ore, litigation followed over the validity of the extension of the lease. This litigation resulted in a compromise in May 1910, and the Stall brothers resumed operations under the management of H. C. Cutler. In September of the same year the lease was sold to the National Mining Co. For a number of months prior to the time the lease was sold, it is reported to have produced from $250,000 to $275,000 per month. The National Mining Co. operated for a number of years, and the history of the district is largely the history of this one mine. Cutler[12] speaks of the richness of the ore as follows:

> The high grade ore, assaying over $20 per pound, was taken out in sacks to the mill, crushed in a small Blake crusher to 1/2-inch size, and then recrushed in a laboratory crusher to 1/4-inch. From this crusher it passed to a no. 2 cone grinder, and finally to a Braun disk pulverizer, where it was ground to 60-mesh. The pulp was placed in an arrastra (4-feet pan) with quicksilver and amalgamated for 6 hours. About 105 pounds of ore were worked per charge and four charges in 24 hours. An extraction of 98 to 99.5 percent was made and tailing shipped to smelter. About $650,000 was turned out by this mill in a little less than 3 months.

So rich was the National mine ore that, in order to prevent "high-grading", a steel tower was built near the entrance to the mine, from which an armed guard kept watch night and day. A large searchlight surmounted the tower, and at night its rays played upon the entrance to the mine.

After the district passed its peak of production the only activity was sporadic leasing operations until 1935, when the increased price of gold stimulated a revival of activity. Production of the district is shown in table 4.

The geology of the mineral deposits of the district has been described by Lindgren[13] and by Winchell[14].

12/ Cutler, H. C., National: Nev. Min. & Sci. Press, vol. 101, 1910, pp. 606-607.

13/ Lindgren, W., Geology of the National Mining District: Min. & Eng. World, vol. 35, 1911, pp. 1175-1176.

14/ Winchell, A. N., Geology of the National Mining District: Nev. Min. & Sci. Press, vol. 105, 1912, pp. 655-659.

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TABLE 4. - Gold, silver, copper, and lead production from National District, Humboldt County, Nev., 1909-36

[Compiled by Charles White Merrill, Mineral Production and Economics Division, Bureau of Mines]

Year	Lode					
		Ore	Gold		Silver	
	No. of mines	Short tons	Fine ounces	Value	Fine ounces	Value
1909.....	2	173	4,544.44	$93,942	4,673	$2,430
1910.....	3	53	60,451.50	1,249,643	61,854	33,401
1911.....	20	894	39,197.36	810,281	40,153	21,281
1912.....	3	4,514	27,837.35	575,449	33,719	20,737
1913.....	8	62	5,986.31	123,748	6,421	3,878
1914.....	6	2,809	3,850.32	79,593	13,925	7,701
1915.....	3	18,732	9,188.41	189,941	23,772	12,052
1916.....	2	27,478	5,928.54	122,554	13,075	8,603
1917.....	2	15	20.83	431	17	14
1918.....	3	38	1,012.00	20,920	4,444	4,444
1919.....	5	19	719.72	14,878	2,397	2,685
1920.....	2	11	1,093.00	22,594	3,662	3,992
1921.....	1	7	893.04	18,451	1,295	1,295
1922.....	1	3	403.12	8,333	465	465
1923.....	7	109	573.49	11,855	9,654	7,916
1924.....	1	1,099	1,096.06	22,658	27,771	18,607
1925.....	2	140	106.68	2,205	3,959	2,748
1926.....	2	2	9.12	189	193	120
1927.....	1	75	1.45	30	7,076	4,012
1928.....	2	238	785.90	16,246	19,727	11,540
1929.....	2	97	1,218.76	25,194	35,776	19,069
1930.....	—	———	———	———	———	———
1931.....	—	———	———	———	———	———
1932-36.....	—	2/	2/	2/	2/	2/
	—	85,045	175,501.96	3,774,215	457,190	289,836

See footnotes on page 34.

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TABLE 4. - Gold, silver, copper, and lead production from National District, Humboldt County, Nev., 1909-36 - Continued

[Compiled by Charles White Merrill, Mineral Production and Economics Division, Bureau of Mines]

Year	Lode					
	Copper		Lead		Total value	Average recoverable value of ore per ton[1]
	Pounds	Value	Pounds	Value		
1909	----	----	----	----	$96,372	$557.06
1910	----	----	----	----	1,283,044	24,208.38
1911	60	$8	390	$18	831,588	930.19
1912	----	----	----	----	596,186	132.07
1913	28	4	----	----	127,630	2,058.55
1914	----	----	----	----	87,294	31.08
1915	----	----	----	----	201,993	10.78
1916	----	----	----	----	131,157	4.77
1917	----	----	----	----	445	29.67
1918	----	----	----	----	25,364	667.47
1919	----	----	----	----	17,563	924.37
1920	110	20	----	----	25,606	2,418.73
1921	----	----	----	----	19,756	2,822.29
1922	----	----	----	----	8,798	2,932.67
1923	234	34	14	1	19,806	181.71
1924	281	37	333	27	41,329	37.61
1925	----	----	----	----	4,953	35.38
1926	----	----	----	----	309	154.50
1927	550	72	2,101	132	4,246	56.61
1928	893	129	2,407	140	28,055	117.88
1929	792	139	6,369	401	44,803	461.89
1930	----	----	----	----	----	----
1931	----	----	----	----	----	----
1932-36	(2)	(2)	(2)	(2)	(2)	(2)
	3,434	482	13,946	805	4,065,338	47.80

1/ Not to be confused with average assay value of ore.
2/ Bureau not at liberty to publish figures, but concealed figures included in totals.

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Buckskin National Gold Mining Co.

The Buckskin National Gold Mining Co. property comprises 2 patented and 9 unpatented claims on the northeast slope of Buckskin Peak at an altitude of about 8,100 feet above sea level, 3 miles southeast of the camp of National. The nearest railroad point is Winnemucca, about 60 miles south. The Buckskin National Gold Mining Co. was incorporated in Nevada in 1912 with a capitalization of $1,250,000 shares, par value $1, nonassessable. The mine has been operated intermittently under company management and by lessees. It was formerly equipped with a 100-ton flotation mill, but it was found that the flotation process was unsuitable for the ores. For the past two years the property has been operated by the Nevada Lucky Tiger Mining Co. under a lease agreement. In June 1937 fifty men were employed in the production of 50 tons of ore per day.

Development includes three adits, the longest 1,250 feet, an underground shaft 400 feet below the 100-foot adit level, and other workings totaling 6,500 feet. Equipment includes a 75-horsepower, Fairbanks-Morse, Y-type, Diesel engine connected to a 350-cubic-foot-capacity Sullivan compressor, an electric hoist, and a 50-ton cyanide mill. Power for milling is furnished by a 150-horsepower, 3-cylinder, Fairbanks-Morse, Diesel engine connected to a generator.

Ore is present in a quartz fissure vein having a strike of north 15° west, a dip of 76° westerly, and an average width of 4 feet. The values are in gold and silver. Formation is rhyolite and andesite. On the 10-foot level, the vein has been opened up for a length of 3,000 feet. The average grade of the ore mined is $16 per ton.

Ore is mined by the open-stope method. Mining and milling costs for the month of May 1937, when 1,511 tons of ore were treated, was as follows:

Stoping	$2.308
Development	3.310
Milling.	2.916
Marketing	.062
General	.361
Cost per ton . . .	8.957

Mine development for the same period was 448 feet, and the average cost per foot of development was as follows:

Labor	$7.177
Supplies	3.060
General charge . .	.053
Miscellaneous . . .	.115
Average cost per foot	10.405

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Ore is treated by the all-slime cyanidation process. The mill flow sheet is shown in figure 2. The ore is ground to 80 percent minus-200 mesh. Cyanide consumption is 2.1 pounds, lime consumption 16 pounds, and ball consumption 3.1 pounds per ton. On $16 ore, the extraction of the gold is 96 percent, silver 85 percent, and the over-all extraction 92.6 percent. Water for milling is obtained from a spring in the vicinity and from the mine workings. The flow of water in the mine is about 35 gallons per minute. The mine water contains considerable sulphuric acid. The cost of generating electricity is 1.2 cents per kilowatt hour.

National Mine

The National Mine comprises a group of eight patented claims owned by P. H. O'Neil and associates of Los Angeles, Calif. The mine was acquired by the present owners in 1928 at a foreclosure sale. When the writer visited the property in June 1937 a crew of eight men was employed. Development consists of 10 adits, 3 shafts, and other workings, totaling about 6 miles. The main adit has a length of 1,950 feet; the mine workings below this adit are filled with water. Nearly all the ore was mined from above the main adit level. The property is equipped with an 80-horsepower, Fairbanks-Morse, semi-Diesel engine connected to a generator, an Ingersoll-Rand compressor (9 by 8 inches), and a 10-stamp mill (1,051-pound stamps). Other mill equipment includes a jaw-crusher (9 by 16 inches), a ball mill (4 by 5 feet), two amalgamation plates, and two Wilfley tables. At the time of the writer's visit, hand methods of mining were employed. Small lots of high-grade ore mined were either treated by amalgamation in the small laboratory-size ball mill at the mine or shipped to smelters.

The formation consists of Tertiary lavas, chiefly rhyolite, andesite, and basalt. The ore deposits occur in quartz veins of two types, one containing copper, lead, and silver and the other gold and silver. The general strike of the veins is north and south, with a steep east or west dip. Lindgren[15] considers the veins of the camp to be low-grade silver veins with a small gold content, and the rich gold shoot of the National vein an unique occurrence. The rich shoot of the National vein contained electrum, an alloy of gold and silver. The width of this vein varies from 6 inches to 2 feet. Stibnite is the most characteristic sulphide in the vein material.

A shipment made to American Smelting and Refining Company (Selby Smelter) on April 14, 1937 gave the following return:

Metal quotations:	Au	$35.00 per ounce
	Ag	$ 0.77 per ounce
Settlement assay:	Au	96.184 oz.
	Ag	117.90 oz.
	As	2.30 percent
	Sb	.20 percent

15/ Lindgren, W., Work cited (footnote 13), p. 32.

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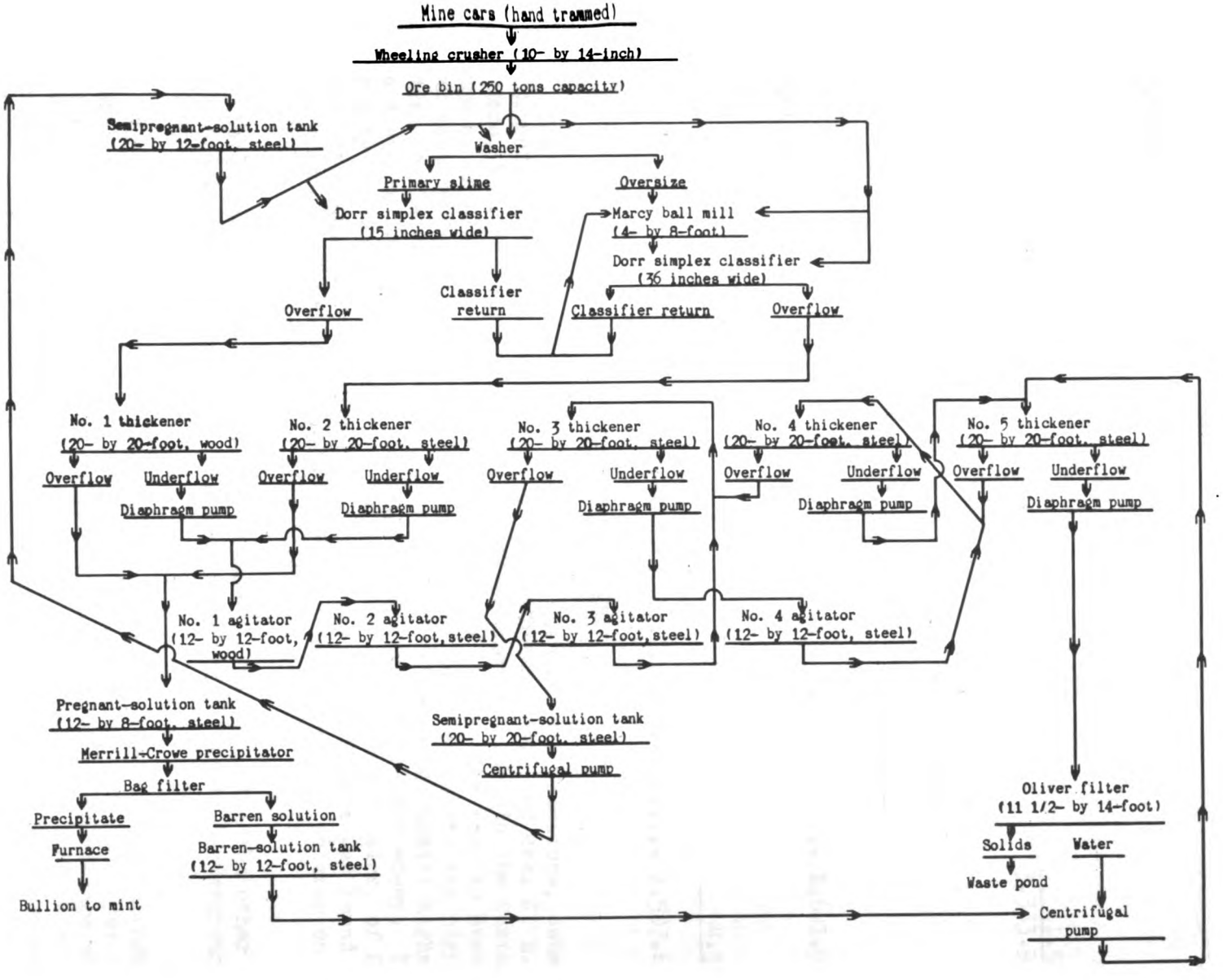

Figure 2.- Flow sheet of Nevada Lucky Tiger mill, National district, Humboldt County, Nev.

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Metal payment:	96.184 oz. Au at $33.8346825		$3,259.19
	117.90 oz. Ag, less 5%, at .77		86.24
	Total		3,345.43
Treatment charge:	Base charge	$10.00	
	As and Sb (over 1%)		
	1.5% at $0.50	.75	
	Handling sacks	.75	
		11.50	11.50
	Net value per ton		3,333.93
Weight:	Gross weight, 12 sacks	1,020 lbs.	
	Tare	20 lbs.	
		1,000 lbs.	
	Less moisture, 1.5%	15 lbs.	
	Net weight.....	985 lbs.	
	985 lbs., or 0.4925 ton, at $3333.93		1,641.96
Deductions:	Sampling and assaying	10.00	
	Express	34.35	
	Sampling	10.00	
		54.35	54.35
	Net proceeds		1,587.61

McCormick Group

The McCormick group of 18 unpatented claims and 2 fractions, owned by D. C. McCormick and John Dermody, of Rebel Creek, Nev., and Mrs. J. E. Ward, of Reno, Nev., is situated on the summit of Buckskin Peak in the Santa Rosa Range at an elevation of 8,600 feet above sea level. The road to Buckskin Peak goes up Canyon Creek gulch to the divide and then skirts the high ridges at the crest of the range. From the Winnemucca-McDermitt highway the distance is 15 miles, of which the last seven are fairly steep. The property was located a number of years ago by Chalmers McCormick, of Rebel Creek, as a gold-silver property, but nothing of importance was found until 1929, when John Dermody discovered cinnabar in a prominent outcrop on Buckskin Peak. The production of quicksilver has been 58 flasks.

Development comprises two shafts, one 42 feet deep and the other 58 feet, and several adits, the longest of which is 300 feet. Underground workings total about 600 feet.

Equipment includes an Ingersoll-Rand portable compressor, jackhammer, several camp buildings, and a D-retort with a capacity of 2 tons per 24 hours. The ore treated in this D-retort was hand-sorted to average about 5 percent quicksilver. The ore is crushed to about 1-inch size in a Joshua-Hendy jaw crusher (8 by 8 inches) belt-connected to a 6-horsepower gasoline engine. About 700 pounds of ore are treated per charge; the oil consumption is about 20 gallons per ton of ore. Water for domestic use is available from several springs on the ground.

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The cinnabar occurs in a rhyolite that has been altered extensively by hot-spring action. The croppings are very rugged and prominent, covering an area roughly 1,000 feet long and 500 feet wide. Most of the work has been done on the northeast end of the deposit. In general the rhyolite has been altered to a gray chalcedony, vesicular in character, in which the cinnabar occurs as disseminations and seams. The distribution of cinnabar over a large area is promising, and the future of the deposit depends to a great extent on whether the average grade of the ore is high enough to work on a large scale. According to Don C. McCormick, preliminary sampling indicates that the average grade of the ore is better than 5 pounds of quicksilver per ton.

PARADISE VALLEY DISTRICT

The Paradise Valley, also known as the Mount Rose, district is on the east slope of the Santa Rosa Range, about 11 miles northwest of the town of Paradise Valley. The nearest shipping point is Winnemucca, 60 miles a little west of south from the old camp of Spring City in the central part of the district. The first locations in this area were made in 1868; it was organized as the Mount Rose district in 1873. The mines were worked actively from 1879 to 1891. Subsequently, a revival of interest took place from 1907 to 1915 and again from 1931 to 1935, when small amounts of silver ore were mined.

The total production from the district is probably in the neighborhood of $1,500,000, although some estimates are as high as $3,000,000. Nearly all the production was made prior to 1900, when complete statistics on mineral production were not compiled. According to Burchard,16/ from January 1879 to December 1883 the Paradise Valley mine produced $366,735.

According to Gus Rogers, of Winnemucca, the records of the old Silver Butte Mining Co. show a production of $706,405 from March 1883 to April 1887, out of which $150,000 was paid in dividends. In the early days the ores were crushed in stamps and treated by pan amalgamation. The tailings from these early-day mills were reworked twice, the last time in 1913 and 1914. The principal property in the district was the Silver Butte Mining Co.

Silver Butte Claims

Fourteen unpatented claims formerly included in the property of the Silver Butte Mining Co. were relocated by Gus Rogers and associates, of Winnemucca, in 1931. Subsequently, the claims were taken over by a group from Astoria, Oreg., and a small mill was erected, which treated several thousand tons of low-grade ore obtained by screening the dumps. It closed down in 1935. When the writer visited this area in June 1937 there was no activity.

16/ Burchard, H. C., Report, Director of the Mint, on the production of precious metals in 1883, pp. 515-529.

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The principal veins cut across a steep mountain, affording a good opportunity for development by adits at different elevations. Total development consists of about 2 miles of underground workings, including at least seven adits and two vertical shafts, one shaft, on the Wild Goose, having a depth of 600 feet and the other, on the Bullion vein, 400 feet.

Mining equipment includes a Schramm-Johnson compressor, blacksmith shop, rock drills, and assay office. Mill equipment consists of a jaw-crusher, a ball mill (4 by 5 ft.), 6 Denver Sub-A flotation cells, and an American filter (4 1/2 feet in diameter). Power for milling is furnished by one 80-horsepower and one 40-horsepower Fairbanks-Morse Diesel engine, both belt-connected to a D. C. generator.

The ore occurs in quartz fissure veins in calcareous slate cut by rhyolite dikes. Four of the veins have been productive and are known as the Wild Goose, Paradise, White Swan, and Bullion. The veins have a general strike of north and south with an easterly dip of from 75° to 80°. The average width of the veins is about 4 feet, although one stope on the Bullion vein is said to have a width up to 25 feet. In places where the veins are barren, the widths of vein matter are considerably greater. The principal value in the ore is in silver associated with some gold. In the oxidized zone the silver occurs as cerargyrite and in the sulphide zone as pyrargyrite and argentite. At depth the mineralization is chiefly sphalerite and pyrite and the precious-metal value decreases.

Charlestown Hill National Mines, Inc.

The Charleston Hill National Mines, Inc., consists of a group of 11 unpatented claims on the west slope of the Santa Rosa Range, about 7 miles northeast of Paradise Station. This company is a Montana corporation formed in 1916 with a capitalization of 1,000,000, shares par value $1. The president and principal owner is Mrs. Mary L. Clough, 2750 Vallejo St., San Francisco, Calif. A small production has been made in the past by lessees. Except for the annual assessment work, the property has been inactive since 1929.

Development consists of several adits, the longest of which is 1,200 feet, and other workings totaling about 2,000 feet. Equipment consists of a 120-cubic-foot-capacity compressor and a small mill equipped with two Straub stamp mills, jaw-crusher, and a concentrating table powered by a 37-1/2-horsepower, Fairbanks-Morse, Diesel engine.

The formations are slate, shale, and porphyry. The vein exposed in the 1,200-foot crosscut adit has a north and south strike and dips 50° east. The width is 2 feet. The gangue is a hard white quartz showing a little disseminated chalcopyrite and small values in gold and silver.

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Cahill Group

In 1936 J. H. Cahill, of Reno, Nev., discovered cinnabar on the west slope of the Hot Springs Range about 15 miles southeast of the town of Paradise Valley. A group of six unpatented claims is owned by Cahill and associates. The claims are in the prospect stage of development and no production has been made.

Development consists of three adits totaling 300 feet of workings. When the writer visited the property in June 1937, the owners were driving an adit to intersect the deposit at depth. This work was being done by hand methods.

Cinnabar occurs in seams and as disseminations in a fracture zone in limestone.

POTOSI DISTRICT

The Potosi, also known as Kelly Creek, district is in eastern Humboldt County at the north and east slopes of the Osgood Range. The district was first prospected in the eighties for copper and silver, but no important discoveries were made at that time. A number of tungsten deposits of the contact metamorphic type were discovered in this area during the World War period, and although some of them have been prospected, there is no record of any production. In 1933 gold was discovered in this district by Edward Knight and Emmett Chase of Winnemucca, Nev. In 1934, after a small amount of preliminary prospecting, the property was purchased by Noble H. Getchell, of Midas, Nev. The Getchell Mine, Inc., was organized, and exploration work continued on a broad scale, so that in 1937 it was one of the outstanding mining developments in Humboldt County.

Getchell Mine, Inc.

The Getchell Mine, Inc., is a Nevada corporation with a capitalization of 1,500,000 shares with no par value. George Wingfield, Reno, Nev., is president, and Noble H. Getchell, Midas, Nev., is vice-president. The property comprises a large acreage of patented railroad land and unpatented mining locations at the north and of the Osgood Range, about 27 miles by road northwest of Golconda and 16 miles north of Red House, a station on the Western Pacific Railroad, the nearest shipping point.

Development consists of several adits and subsidiary workings totaling about 4,000 feet. Equipment consists of an Ingersoll-Rand 2-drill compressor, blacksmith shop, and camp accommodations for 50 men. In June 1937 ground was being broken for the erection of a 400-ton mill, and an electric power line was under construction to the mine. The power line was being built by the Sierra Pacific Power Co. from a point near Mill City to Winnemucca and thence to Golconda and north to the mine.

Due to the complex character of the ore, the complete details of the mill flow sheet had not been worked out at the time of the writer's visit.

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Gold with a small amount of silver occurs in a mineralized zone in a black silicified limestone. The ore zone has a strike of north 20° west and a dip of 40° easterly. The hanging wall of the deposit consists of a fault zone about 60 feet wide. The footwall is a white limestone in contact with granite. Near the surface the ore is oxidized, while at depth arsenical sulphides are present in the form of realgar and orpiment. Since the deposit dips with the slope of the mountain, it will be possible to mine a large portion of it by the open-cut method. A large tonnage of ore ranging from $5 to $12 per ton has been blocked out.

Tungsten Deposits

A number of tungsten deposits of the contact metamorphic type occur on the east slope of the Osgood Range. The deposits were discovered at the time of the World War and were prospected to some extent at that time. In recent years there has been little activity on the tungsten claims in this area. There is no record of any production of tungsten concentrates.

Joseph Fayant of Golconda, Nev., and Bert Kirby of Winnemucca, Nev., own six unpatented claims 25 miles north of Golconda near the Pinson ranch. M. J. Tierney of Sunburst, Mont., owns 60 acres of patented land 20 miles north of Golconda. Frank Saunders of Winnemucca owns three unpatented tungsten claims. A number of other tungsten claims in this area are owned by various individuals.

The description of the deposits is given by Hess and Larsen[17]. The tungsten occurs as scheelite in a gangue composed chiefly of garnite, epidote, quartz, and calcite in sedimentary formations intruded by quartz diorite.

RED BUTTE DISTRICT

The Red Butte district is on the west slope of the Jackson Mountains, 25 miles by road northwest of Jungo, Nev. The last 12 miles of the road are virtually impassable by automobile with a low clearance.

This area was first prospected for gold in 1907 by August Ramel of Red Butte. Subsequently, exploration work was confined to copper deposits. Most of the copper claims in the district are owned by Ramel. According to W. W. Wells of Winnemucca, the total production has been three carloads of copper-lead ore, one carload of lead-zinc-silver ore, and about 20 tons of antimony ore, nearly all of which was shipped during the War period.

A brief description of the geology of the district is given by Ransome[18]

17/ Hess, Frank L., and Larsen, Esper S., Contact Metamorphic Tungsten Deposits of the United States: Geological Survey Bull. 725-D, 1921, pp. 300-304.

18/ Ransome, Frederick L., Notes on Some Mining Districts in Humboldt County, Nev.: Geological Survey Bull. 414, pp. 28-30.

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The prevailing rock is gabbro cut by dikes of aplite. The copper deposits are closely associated with aplite dikes. The copper minerals are generally oxidized and associated with iron oxides and a little barite. The deposits have never been developed beyond the prospect stage.

Several miles southeast of Red Butte, two unpatented antimony claims are owned by W. W. Wells of Winnemucca. The antimony occurs in a quartz vein as oxides on the surface and as stibnite at depth. Formation is diorite and andesite.

SAWTOOTH DISTRICT

Sawtooth district is on the Pershing-Humboldt county boundary line about 20 miles a little south of west from Jungo, a station on the Western Pacific Railroad. Intermittent prospecting for lode deposits has been done for a number of years, but the results have been discouraging.

Placer gold was discovered in this area in 1931 by Rufus Stevens as a result of prospecting stimulated by the discovery of gold veins in the Scossa district, 12 miles to the southeast. Shortly after this discovery a number of claims were located, and before the end of the summer of 1931 as many as 35 men were dry-washing in this area with variable results.

Several of the more fortunate individual placer miners recovered as much as $35 per day for short periods. In 1932, the Oregon Nevada Mining Co. acquired about 300 acres and attempted to work the gravels on a large scale, but this venture was unsuccessful and the ground was taken over by A. A. Goehring of Sawtooth, and associates. According to John G. Huntington of Sawtooth, the production of placer gold has been about $12,000. In recent years the ground has been leased to individuals on a rental basis of 25 cents per day for each hand-driven dry washer and 50 cents per day for each power dry washer employed. Very little water is available in the immediate vicinity.

Placer gold has been found over a fairly level area of about 6 square miles. An unusual feature of the placer is that the best values are found at shallow depths. Much of the gold has been found above a false clay bedrock at depths of 8 inches to 2 feet. No shafts have been sunk in the district to prospect the true bedrock. The gravel is rough and angular, with a small percentage of boulders. A considerable amount of clay is present in places, and the clayey material has to be dried and pulverized before a satisfactory saving of gold can be made with dry washers. The gold is coarse and rough and averages about 880 fine. Small nuggets worth up to $4.50 have been found.

SHERMAN DISTRICT

The Sherman district is on the east side of the Bloody Run Range, 23 miles north of Winnemucca, the nearest shipping point. Gold was discovered here in 1922 by Jack Castacao, a sheepherder. The principal production from this area has been made by the Basque Mining and Milling Co.

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Basque Mining and Milling Co.

The Basque Mining and Milling Co., a Utah corporation organized in 1927, owns 12 unpatented claims and 1-1/2 sections of patented land purchased from the Southern Pacific Railroad. Capitalization of the company is 2,000,000 shares, of which about 1,000,000 shares have been issued. Par value is 10 cents per share. Control of the stock is held by T. Honma, and G. O. Koriyama, Japanese, of Winnemucca, Nev. In 1930 the company erected a 25-ton-daily-capacity amalgamation concentration mill, which operated intermittently until 1934. From the tailings pile below the mill, it is estimated that about 800 tons of ore were treated. In addition several carloads of ore were shipped to smelters. In 1937 the property was leased to James Taylor and Edwin S. McNeil, of Salt Lake City, Utah; in June 1937 the lessees employed eight men on the property.

Development consists of six adits, the longest of which is 700 feet, and other workings, totaling about 5,000 feet.

Mining equipment includes two compressors, one a Gardner-Denver (10 by 12 inches) and the other a Gardner with a capacity of 160 cubic feet, a Sullivan drill sharpener, rock drills, and other mining tools.

Mill equipment consists of a small Straub crusher, Joshua Hendy ball mill (3 by 5 feet), amalgamation plate (4 by 10 feet), and two Butchard concentrating tables. Power for mining and milling is furnished by a 75-horsepower, Fairbanks-Morse, Y-type, 2-cylinder, Diesel engine connected to a 50-kv-a generator. There is also an assay office, blacksmith shop, and camp accomodations for 12 men. Water for milling and domestic use is obtained from several springs in the vicinity.

In June 1937 the lessees had erected a small Straub mill on the property. This mill had a capacity of 3 1/2 tons per 8 hours; recovery was made by amalgamation.

The formation is slate cut by several nearly parallel diorite dikes. The ore occurs in a vein system that strikes north and south and dips about 65° to the west. The width of the vein material ranges from 4 to 12 feet. The values are all in gold, which occurs in a free state in a quartz gangue. The average grade of the ore mined at the time of the writer's visit was $12 per ton.

Jupiter Group

The Jupiter group of two unpatented claims owned by Rudolph Winkler of Winnemucca, Nev., is on the west side of the Bloody Run Range, 28 miles by road northwest of Winnemucca. This property was located in the early days, but there is no record of any production.

Development consists of an inclined shaft 30 feet deep, two adits, and several open cuts, totaling about 150 feet of workings. There is no equipment on the property. Small amounts of molybdenite and scheelite are present in two quartz veins that strike north and south and dip about 35° to the east in a granite formation. The average width of the veins is about 5 feet.

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SULPHUR DISTRICT

The Sulphur, also known as the Black Rock, district is on the northwest flank of the Kamma Mountains and on the southeast border of the Black Rock Desert. Sulphur, a station on the Western Pacific Railroad, is about 2 miles northwest. Sulphur deposits were discovered here by Indians, who showed them to white men in the seventies. According to Whitehill[19], the first locations were made in March 1875 by Messrs. McWorthy and Rover. Shortly after other locations were made in this area by Messrs. Hale and Wright who sold their claims to the Pacific Sulphur Co. This company erected a refinery and operated it for about 8 years, producing from 6 to 7 tons of sulphur per day. In 1900 the deposits were acquired by the Nevada Sulphur Co. of San Francisco, which operated for several years. Prior to 1911 the sulphur produced was hauled 35 miles to Humboldt, a station on the Southern Pacific Railroad, formerly Central Pacific Railroad. In 1911 the transportation cost was reduced by the completion of the Western Pacific Railroad, which passes within 1 1/2 miles of the sulphur deposits. In 1917 the deposits were purchased by the California Rex Spray Co.; this company and others were intermittently active up to 1929.

In 1908 rich silver ore was discovered by a man named Moonsey at the south end of the sulphur deposits. Silver ore was mined for a number of years, principally by lessees, who are reported to have produced shipping ore having a value of more than $100,000.

California Rex Spray Co.

The California Rex Spray Co. controls about 1,000 acres of patented sulphur-bearing ground. The principal owners are Frank B. McKevitt, Jr., Vacaville, Calif., Alexander S. Butler, Penryn, Calif., and S. H. Beetem of Benicia, Calif. After purchasing the property in 1917, the California Rex Spray Co. operated for 4 years, when it was leased to the Redwood Lumber Co. of Calif. The latter company operated for one year, and in 1924 the lease was taken over by the Humboldt Sulphur Co. This company operated until 1929, when it went into the hands of a receiver. Subsequently, the property was again leased to a company known as the Sierra Sulphur Co., Inc., which never operated, and in 1934 the property reverted to the present owners. In June 1937 all the mining, milling, and power equipment on the property was sold at auction. Statistics on the production of sulphur are not available, but, judging from the extent of the workings, the huge tailings pile, and some sketchy data on the early day activity, it is estimated roughly that at least 40,000 tons of sulphur have been produced. The sulphur was mined either by quarrying or by the room-and-pillar system.

The deposits are distributed over an area several miles long and 1 mile wide. The sulphur occurs as crystal masses on the walls of cavities and in disseminated form in a highly altered siliceous rock cemented by quartz and

19/ Whitehill, Henry R., Biennial Report of State Mineralogist, State of Nevada, 1875-1876: Carson City, Nev., p. 65.

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chalcedony. In some of the cavities the sulphur is solid and appears to have flowed through the channels in the rocks in liquid form. A considerable amount of alunite, some gypsum, and a small amount of cinnabar is associated with the sulphur. Most of the sulphur mined in the past was obtained from shallow depths. The sulphur content of the material as mined varied from 15 to 85 percent.

Processes for Recovering Sulphur

Various processes have been employed by successive companies in recovering sulphur from the aforementioned deposits. A description of the process used in the seventies and eighties by the Pacific Sulphur Co. was as follows:20/

> The crude sulphur is melted in large oblong iron pans. It is run off from this first pan into another similar one, which is covered with perforated iron plates. These plates are covered with ordinary sacking material, through which the sulphur, when discharged from the first pan, is strained. A considerable portion of impurities still passes through the meshes of the sacking - indeed, the greater portion goes through with the melted sulphur, but it afterwards settles at the bottom of the pan. This straining process is not so much for the purpose of catching whatever impurities may be with the sulphur as it is to aid in the settling process that takes place in this second pan; for it seems that if this operation is omitted there will be no separation of the sulphur from the other elements that are in combination with it. A new set of sacking is used for each charge run out from the first pan, but several charges are deposited in the second pan before the purified sulphur is run off and the settlings are removed. A slow fire is kept up under the second pan to prevent the sulphur from congealing, so that the settling may take place. The pure sulphur is run off into cylindrical molds made of galvanized iron and a little larger at the top than at the bottom, so that the rolls of sulphur may be taken out the more easily when it is cooled. These rolls weigh about 150 pounds each and are, without any further process, ready for shipment. The capacity for refining at these works, which have two pans for the first operation and one for the second, is about 7 tons daily of refined sulphur. The cost of hauling the crude material from the mines to the refinery is $2.50 per ton; freight to the railroad is $10 per ton, and from there to San Francisco, $10 per ton. There is a market on the Pacific Coast for about 300 tons monthly.

In 1900 the Nevada Sulphur Co. recovered the sulphur by retorting. Two retorts, each having a capacity of 2 1/2 tons per charge, were employed. The retorts were made of cast iron, 10 feet high, the body of which was shaped like a frustum of a cone and having a semispherical bottom. The

20/ Whitehill, H. R., Work cited (footnote 19), p. 44.

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retort was filled from the top and the charge was carried on a grate about 7 feet from the top. When the chamber was filled, the top and side doors (the latter used for discharging the waste) were sealed, and steam was turned into this retort at a pressure of 70 pounds to the square inch. The melted sulphur dropped through the grate into the kettlelike bottom of the retort, from which it was drawn off, together with the water resulting from the condensing steam, into a settling pan kept at a temperature sufficiently high so that the sulphur remained in the liquid state. From the settling pan the sulphur was run into cast-iron cone-shaped molds having a capacity of 250 pounds each. After hardening in the molds, the sulphur was broken up into small pieces, which were put through a crusher, which reduced it to pea size for marketing. Some of it was ground by buhrstones for flour sulphur and packed in sacks containing 110 pounds each.

A description of the process employed by the Humboldt Sulphur Co. in 1929 is given by Hazen21/. The crude ore was first crushed in gyratory and roll crushers to about 3/4 inch, then ground to 48 mesh in a Hardinge ball mill operating in closed circuit with a Dorr classifier. The ground pulp was elevated by a Wilfley sand pump to Kraut flotation cells, the concentrate from which was cleaned and recleaned in Forester type machines. The sand was removed from the flotation tailing by a Dorr classifier and sent to waste. The slime tailing was thickened in Dorr tanks and as much water as possible recovered. The flotation concentrate was thickened in a Dorr tank and then dewatered by an Oliver filter.

Many flotation re-agents were tried, but the best results were obtained with Aerofloat No. 15; about 0.05 pound of this re-agent alone were used per ton of ore. Recovery averaged about 85 percent of the sulphur originally in the ore. The concentrate averaged 77 percent sulphur, and mill heads, which were made up of half mine and half dump ore, about 15 percent sulphur.

The flotation concentrate was refined by the Hazen process (patented). In this process the sulphur was refined in a large retort having a capacity of 35 tons pure sulphur per 24 hours from a flotation concentrate analyzing 77 percent sulphur. The batch system was employed, and on an average the cycle produced 5 tons of pure sulphur in a little less than 3 1/2 hours. The sulphur produced was quite pure, the lowest-grade carload sold averaged 99.6 percent and the highest-grade carload 99.85 percent sulphur.

Alunite Deposits

Alunite veins occur in the vicinity of the sulphur deposits. Although the presence of the alunite was known as far back as 1900, it did not receive any attention until 1917, when a number of lode claims were located. The only production of alunite has been about 500 tons shipped in the crude state to the Pacific coast for use as fertilizer.

21/ Hazen, H. L., Recovering Sulphur From a Nevada Surface Deposit: Eng. & Min. Jour., vol. 127, May 25, 1929, pp. 830-831.

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The alunite veins have been prospected by several short adits and shallow shafts totaling about 500 feet. There is no equipment on the ground.

A description of the deposits is given by Clark[22/].

The alunite occurs in at least three parallel veins ranging from 2 to 15 feet in width and with a steep dip. The country rock is principally rhyolite breccia, which is covered in places by tuff and detrital material. The veins are traceable on the surface for a considerable distance. Where exposed to weathering, the alunite is soft and powdery but becomes harder with depth.

Three analyses made on the alunite, according to Clark, are as follows:

	Percent		
	No. 1	No. 2	No. 3
Insol (SiO_2)	0.09	1.6	2.0
Al_2O_3	37.4	37.52	37.9
Na_2O	2.31	2.36	2.27
K_2O	8.63	9.54	9.10

Silver Deposits

The silver deposits occur at the south end of the sulphur deposits a short distance from a place called the Devil's Corral, a natural amphitheater formed by highly colored rocks. The principal property in the early days was the Silver Camel mine, which is reported to have produced $100,000 in high-grade silver ore from 1908 to about 1912, principally by lessees. In recent years the only mining has been done by James Brown of Sulphur, Nev., on the Hornsilver claim.

Development consists of a number of trenches and shallow shafts totaling about 1,500 feet. The deepest shaft is 95 feet deep. There is no equipment on the ground, and all mining in former years was done by hand methods.

The silver occurs as corargyrite (hornsilver) in narrow seams varying from a fraction of an inch up to 4 inches in width. No ore was found at a depth greater than 20 feet from the surface. An adit was driven 300 feet to tap the ore zone at depth, but it did not disclose anything of importance. The deposits are unusual in that the narrow seams of cerargyrite occur in a cemented conglomerate.

22/ Clark, I. C., Recently Recognized Alunite Deposits and Sulphur, Humboldt County, Nev.: Eng. & Min. Jour., vol. 106, pp. 159-163.

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VIRGIN VALLEY DISTRICT

The Virgin Valley opal field is in an isolated desert area sparsely populated 25 miles southwest of Denio, Oreg. Precious opal was first discovered here in 1907, and a number of claims were located. The opal field lies within an area approximating 2 miles wide and 10 miles long in certain beds outcropping along the walls and slopes of Virgin Creek Valley. No figures are available on the yield of precious opal, but the quantity has not been large. Exploitation of the deposits has been done intermittently by various individuals from time to time. As far as the writer is aware, no attempt has ever been made to mine the deposit on an extensive scale.

The geology of the Virgin Valley opal field has been described by Merriam[23] and by Kunz[24]. According to Merriam, the formations consist of volcanic ash, tuff, and mud, originally deposited in shallow lakes. The sediments are in part overlain by lava flows. The sedimentary beds have been divided into the upper, middle, and lower divisions. The upper beds contain fossil remains in the form of bones and teeth of mastodons, camels, and other fauna, while the middle beds contain silicified wood and plant remains. It is principally in these middle beds that the opal occurs associated with petrified wood. The gem variety of opal is irregularly distributed and comprise but a small portion of the deposit.

The Virgin Valley opals are of exceptional quality and noted for their brilliance of fire and color; some of the varieties are peculiar to this region and cannot be duplicated elsewhere. They occur in a variety of shapes, chiefly as cast of twigs and branches of trees and as coatings and fillings in petrified wood. The color of the material ranges from deep black to almost transparent white and shows considerable variation in fire and effect. It is said that one large black opal, weighing 17 troy ounces, was found in 1919; the specimen was rated as flawless and the largest black opal known. Much of the opal is checked and of little value for gem purposes. It generally contains an excess of moisture when taken from the deposit, and unless it is carefully cured before it is exposed continuously to the air, it is liable to crack or check and loose some of its beauty. The curing process consists of imbedding the rough opals in balls of clay and storing them under ground or under conditions of partial humidity, so that the drying-out process can proceed slowly.

Mining operations have been confined largely to shallow pits, trenches, and open cuts. The volcanic ash beds in which the gems are found will not support much weight and caves easily, and several miners have lost their lives owing to carelessness in respect to proper timbering of the workings.

23/ Merriam, J. C.: Science, N. S., vol. 26, 1907, pp. 380-382.
24/ Kunz, G. F., On the Occurrence of Opal in Northern Nevada and Idaho: Abstract, N. Y. Acad. Sci. Annals, 21, 1912, pp. 214-215.

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WARM SPRINGS DISTRICT

The Warm Springs district is in northwest Humboldt County in the vicinity of Denio, Oreg., a small settlement on the Nevada-Oregon boundary. It was formerly divided into the Pueblo district on the north and the Vicksburg district on the south. The nearest shipping point is Winnemucca, 105 miles southeast of Denio. The first locations were made in the Pueblo area in the summer of 1863. In the early days, mining in this section was retarded considerably because of its extreme isolation and the hostility of the Bannock Indians. A small mill erected in the district in 1864 was burned by the Indians the following year and the settlers were driven out. Statistics on the production of metals from this area are not available. The principal property (the Ashdown mine) is said to have produced about $400,000.

Ashdown Mine

The Ashdown mine comprises a group of 16 unpatented claims owned by Clarence C. Crow of Hamford, Calif., and is situated 14 miles south of Denio, Oreg. In 1937 the property was under lease and bond to George Mathewson of Denio, who employed three men. This property has been worked intermittently for many years and, judging from the tailings pile, estimated to contain about 50,000 tons, and the extent of the underground workings, a production of $400,000 appears probable.

Development includes 10 adits, the longest of which is 1,500 feet, and other workings totaling about 2 miles.

Mining equipment includes a 1-drill-capacity Buhl air compressor driven by a gasoline engine, jack hammer, blacksmith shop, and mine cars. The mill on the property has a capacity of 1 1/4 tons per hour. Mill equipment includes a Blake-type crusher (9 by 12 inches), two Huntington mills (each 5 feet in diameter and equipped with 60-mesh screens), amalgamating pan (3 feet in diameter), and an amalgamation plate (4 feet wide and 10 feet long). A recovery of 85 percent is made by amalgamation on ore averaging from $9 to $14 per ton. Power for milling is furnished by a 50-horsepower McCormick-Deering gasoline engine. Water for milling is obtained from springs in the vicinity and is piped 2 1/4 miles to the mill by gravity.

The principal vein has a strike northwest-southeast and a dip of 35° to 40° to the northeast. The width of the vein varies from 2 to 10 feet, averaging about 5 feet. Formation is granite. Values are all in gold, which occurs free in a gangue of hard white quartz.

Cowden Mine

The Cowden property comprises a group of 7 unpatented claims on the west slope of the Pueblo Mountains, 3 miles southwest of Denio, Oreg., and about 2 miles south of the Nevada-Oregon boundary line. It is owned by

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T. J. and D. W. Defenbaugh of Denio. The property was discovered in 1894 by Robert Denio and shortly after it was acquired by John Cowden and associates, who organized the Nevada King Mining Co. This company erected a small amalgamation mill, in which a small amount of ore was treated, and did considerable development work. In recent years the property has been inactive.

Development consists of 7 adits, the longest of which is 490 feet, and other workings totaling several thousand feet. There is no equipment on the property. Water for domestic and milling purposes is available near the property from springs at the head of Cowden Canyon. The flow is estimated to be about 75 gallons per minute.

The ore occurs in several veins having a strike north 50° east and a variable dip. The veins are from 2 to 6 feet wide. The vein filling is altered andesite and quartz. Veins have been disturbed by numerous faults.

Other Claims

In the vicinity of Denio, Oreg., in the Warm Springs district, there are a number of other groups of claims, all of which are in the prospect stage. Among these are the New Deal group of 7 unpatented claims owned by Harrison Grove and Frank P. Davis of Denio, and situated in the Pueblo Range 6 miles southwest. On the Hall claim, which is part of this group, there was a small production of ore in the early days.

Development consists of an adit 200 feet long and scattered surface workings. There is no equipment on the property. A large mass of quartz at least 50 feet wide outcrops on one of the claims, and in places it contains iron manganese and copper oxides carrying small values in gold and silver. The formation is chiefly schist and shale.

The Mohawk group of six unpatented claims is 4 1/2 miles south of Denio owned by Joseph Erquiaga and associates of Denio. Development consists of four adits totaling about 800 feet. There is no equipment on the property. Free gold occurs in quartz stringers in schist cut by porphyry dikes. There has been no production.

The Grove group of three unpatented claims owned by Harrison Grove and B. W. Hamilton of Denio is 11 miles southeast of Denio. It was formerly known as the Howard property, and in the seventies several carloads of ore were shipped. When the writer visited the property in June 1937, two men were employed in prospecting a vein on the property. Development consists of a shaft 90 feet deep and scattered workings totaling about 300 feet. Mining is done by hand methods.

The vein strikes north and south and dips 45° west. It's width varies from 2 to 4 feet. Gangue is chiefly quartz containing oxidized copper minerals and low values in gold and silver. Formation is granite.

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The Clipper group of five unpatented claims owned by C. H. Jackson of Denio is on the west slope of the Pueblo Range 5 miles southwest of Denio. In June 1937 this property was being prospected by three men employing hand methods of mining. No production has been made.

Development comprises two adits each about 110 feet long and a shaft 50 feet deep. Free gold occurs in quartz stringers in the highly altered formation, probably granodiorite.

WINNEMUCCA DISTRICT

The Winnemucca district is at the south end of the Bloody Run Range on Winnemucca Mountain 4 miles northwest of the town of Winnemucca on the Southern Pacific Railroad and Western Pacific Railroad. The Barrett Springs section, 12 miles northwest of Winnemucca, is generally considered a part of the Winnemucca district. The first discovery on Winnemucca Mountain was made in 1863 by an Indian named Winnemucca, after which prospecting was carried on for a number of years. In 1872 the Humboldt Reduction Works erected a 10-stamp mill and a roasting furnace at Winnemucca for the treatment of custom ores. Due to the base character of the ore, the treatment charges were unusually high; the company paid 80 percent of the assay values of gold and silver on ores assaying less than $400 per ton and 82 percent on ores assaying over $400 per ton. The treatment charge was $25 per ton for lots of 10 or more tons, $30 per ton for lots of more than 1 but less than 10 tons, and $35 per ton for anything less than 1 ton. The process employed consisted of a chloridizing roast followed by pan amalgamation. No attempt was made to save either lead or copper. The most important mine in the district in the early days was the Pride of the West, which is credited with a production of about $1,000,000.

The first locations in the vicinity of Barrett Springs were made in the spring of 1906, but there was very little activity until 1910, when C. E. Carpenter discovered high-grade gold ore in this area. This discovery created considerable excitement, and the camp soon had a population of several hundred people. In 1911 it was found that the principal claims were on patented railroad land and mining activity came to a standstill until the land was purchased from the railroad.

A number of small companies have been organized from time to time in the Winnemucca district, but the principal production has been made by lessees. According to incomplete statistics in the reports on the metal production of Nevada in annual volumes of Mineral Resources of the United States, the production of the district from 1910 to 1935 was 3,129 tons of ore having a value of $132,433, an average of $42.32 per ton. Values are chiefly in gold and silver, with small amounts of copper and lead.

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Nevada Consolidated Mines Co.

The Nevada Consolidated Mines Co., organized in 1929, comprises nine unpatented claims and 80 acres of patented railroad ground near Barrett Springs. In 1937 the company was involved in litigation and the property was idle.

Development includes a shaft 265 feet deep and other workings totaling several thousand feet. Equipment includes a gasoline hoist, small amalgamation concentration mill, and camp accommodations for 10 men. Mill equipment includes a small Blake-type jaw crusher, Huntington mill, amalgamation plate, and concentrating table.

Ore occurs in quartz fissure veins in shale. The general strike of the veins is about north and south with an easterly dip of 65° to 70°. The width varies from a few inches to 5 feet. Values are in gold and silver associated with a little lead.

Pansy Lee Group

The Pansy Lee group of five unpatented claims adjoining the Nevada Consolidated Mines Co.; this ground is owned by L. E. Case and Erling Prout of Winnemucca, Nev. In 1937 the property was under bond and lease to H. A. Dart and Edward C. Uren, who were developing the property with a crew of four men. In former years this property is said to have produced $60,000 in shipping ore.

Development comprises several adits, a shaft 180 feet deep, and other workings totaling about 1,600 feet. Equipment includes a 1-drill portable compressor and camp accommodations for a crew of six men.

Ore is present in a quartz fissure vein in shale. The average width of the vein is about 17 inches. The smelter returns on a carload of ore shipped by H. A. Dart to the International Smelting and Refining Co. on June 19, 1937, furnished the following data:

Metal quotations:	Au	$35.00 per oz.
	Ag	0.77 per oz.
	Pb	.06 per lb.
Settlement assay:	Ag	36.25 oz.
	Au	.525 oz.
	Cu	.05 percent
	Pb	3.25 "
	Zn	nil
	Insol ..	74.0 "
	Fe	5.6 "
	S	.6 "
	CaO	.6 "
	Mn	4.2 "

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Metal payment:	Ag 95% at $0.77	$26.517		
	Au 91% at 35.00	16.721		
	Pb 50% at .025	.813		
		44.051		
	Less treatment	5.500		
	Net value per ton	38.551		
Treatment charge:	Base rate	$3.00		
	10% charge metal payment over $17.50	2.50 (max.)		
		5.50		
Total weight	90,080 pounds			
Less 1.5% moisture	1,351 "			
	88,729 " , or 44.3645 tons at $38.551			$1,710.30
Deductions:	Freight $4.60 (railroad value $37.83)	$207.18		
	Assaying	4.00		
		211.18		211.18
	Net proceeds			1,499.12

Hauling charge to Winnemucca, a distance of 10 miles, is $1.50 per ton on contract.

Golden West Group

The Golden West group of three unpatented claims owned by Joseph F. Springer of Winnemucca, Nev., and associates is on the west slope of Winnemucca Mountain 4 miles northwest of the town of Winnemucca. These claims were located by Springer in March 1937 in an area that had previously been staked but in which very little prospecting had been done. When the writer visited the property in June 1937, prospecting and sampling operations were being carried on by a crew of four men.

Property has been sampled by churn drilling and trenching. Equipment for this work consisted of a Schramm 1-drill-capacity portable compressor, jackhammer, and a 30-horsepower Caterpillar tractor with a 1-yard-capacity Kilifer rotary scraper. The churn drilling was done on contract at a rate of $2 per foot. In sampling operations the soil and detrital material is removed to a depth of several feet by means of the tractor and scraper, after which trenches about 5 feet wide and 3 feet deep are dug at irregular intervals across the deposit.

Gold is distributed in a shale formation over an area about 1,000 feet long and several hundred feet wide. In places the shale is covered with a thin capping of andesite. The shale is highly altered and traversed by seams of quartz and calcite. There are no pronounced structural feature to the deposit. According to Springer, the sampling results in 800 feet of surface trenching and in six churn drill holes, spaced 50 feet apart and each 50 feet deep, indicate a large tonnage of low-grade ore.

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Water for milling is available from the Humboldt River about 2 miles south of the property.

Gold Hill Group

The Gold Hill group of 11 unpatented claims is on the south slope of Winnemucca Mountain at an elevation of 5,800 feet, and about 4 miles northwest of Winnemucca, Nev. At the time of the writer's visit the property was under bond and lease to Gus Rogers and associates of Winnemucca, who were prospecting the ground with a crew of three men. According to Rogers, the only production has been several thousand tons of ore shipped to smelters. This ore had a high iron content and low values in gold and silver and it was shipped primarily for use of flux.

Development consists of an adit, several open cuts, and other workings, totaling several hundred feet. There is little equipment on the property. Values in free gold associated with a little silver occur in an irregular body of iron-stained material striking about north 50° west and dipping 60° southwest. Formation is principally shale. The gangue is composed almost entirely of iron oxides with small amount of quartz.

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